Open Banking: does it open up a new way of banking?

A case of financial technology adoption from a consumer's perspective

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Abstract

Open Banking, enabled by a common technology standard API (application programming interface), is a financial technology that allows consumers to take control of their financial data and facilitates the exchange of those information among financial institutions. Currently, consumers' financial data are scattered among and stored within the financial institutions with which they have a relationship. With a lack of aggregated data and portability, consumers are often provided with less competitive offers because individual institutions assess them based on a partial picture. It is also not easy for consumers to switch between institutions. With Open Banking, consumers can give consent to financial institutions to exchange their financial data in order to obtain competitive offers. It also facilitates easy offer comparison and switching of accounts. Open Banking is driven by many governments to promote consumer fairness and competition. Consequently, its adoption may lead to significant change in consumers' banking behaviour and loyalty. It may also bring profound implications to the industry in terms of business model, customer management and policy setting.

Given that Open Banking is a new concept, there is no extant research with which to understand its adoption. In particular, its financial technology nature is inherent with risk and trust concerns but presenting interesting research opportunities. This study aims to answer the research question of: *What are the key factors of consumers' adoption for Open Banking and how do the factors affect the adoption?*. It applies an adoption model UTAUT (unified theory of acceptance and use of technology) structurally integrated with perceived risk, initial trust and financial literacy. A quantitative research was done in Australia and partial least square structural equation modelling (PLS-SEM) was performed to analyse the results. The findings suggest that performance expectancy, effort expectancy, social influence and perceived risk are direct antecedents of usage intention. While performance expectancy is the most influential factor, social influence comes second, with a strong mediating effect through performance expectancy to affect usage intention. Initial trust, although not a direct factor, plays an important total effect. It can alleviate perceived risk and positively reinforces performance expectancy and effort expectancy. On the other hand, effort expectancy can also mitigate perceived risk. Furthermore, financial literacy puts a scepticism effect on initial trust i.e. the higher the financial literacy, the lower the initial trust towards Open Banking.

This research contributes empirical understanding towards a new domain by extending an adoption model and demonstrating an integrated approach to theorise the adoption. With the rise of financial technologies this integrated approach advances the body of knowledge by providing a holistic understanding of the roles of perceived risk, trust and financial literacy in adoptions. The understanding of their interactions with traditional adoption factors illuminates new, interesting insights for future research. For practical contributions, this study provides valuable and actionable information for business managers, technical developers and marketers to develop strategies for business, product development, targeting and marketing. It also provides useful recommendations to policy makers on an optimal governance approach balancing the interest of promoting adoption and protecting consumers.

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Statement of Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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I acknowledge the support I have received for my research through the provision of an Australian Government Research Training Program Scholarship.

Signed:

Rebecca Chan

22 June 2020

Dedication

First and foremost, I would like to dedicate this piece of work to my creator – God. I am grateful to Him for giving me a wonderful life and creating me as who I am. As much as I thank Him for the strengths and opportunities that have enabled my achievements, I thank Him for the weaknesses and challenges so that I can keep learning and growing. In particular, I made a decision a few years ago to move from Hong Kong, a place where I grew up with family, friends and established career, to start a different chapter in Australia. He granted me the courage to decide upon and walk a less travelled path, and it turned out to be a very enjoyable one! And for this study, like many other journeys in life, it was not without stumbling blocks and disappointment. But just as always, He has given me the tenacity, wisdom and enough help to sail through to the end.

I would also like to dedicate this academic accomplishment to my sister Monica, who unexpectedly passed away during my candidature. She was not only an outstanding medical doctor, but also a relentless academic researcher. Her departure was a big loss to all who loved her and she will be dearly missed.

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Lastly, I thank Adam Jarvis who has helped the editing work of this paper.

Chapter 1 Introduction

1.1 Research Background

The banking industry is one of the oldest industries in the world (Machiraju 2008; Somashekar 2009). Playing a crucial role in the economy, it has often been described as an oligopoly industry with imbalanced power between the banks and consumers (Larsson 2018). In particular, after the global financial crisis in 2008 the industry has revealed many of its deficiencies including deteriorating trust, lack of competition and insufficient governance (Arner, Barberis & Buckley 2016; Crotty 2009; Dewatripont 2010). In the wake of these issues, there has been an outcry for transformation in favour of consumers. One of the root causes identified for putting consumers at a disadvantage and competition on an uneven playing field is data ownership – consumers' financial data and history are scattered among and owned by individual banks rather than by consumers themselves (Fingleton Associates 2014). Against such a backdrop, Open Banking has emerged as a solution welcomed by many governments aiming to address this issue (Australian Government 2017; Fingleton Associates 2014). Leveraging on technology innovation, Open Banking returns the ownership and control of financial data to consumers, enabling portability and aggregation of their own financial data. This essentially opens up more choices to them and makes switching of accounts easier. In particular, Open Banking is a FinTech (an abbreviation of financial technology) – a term that has emerged to describe financial solutions enabled by technology, highlighting the change of role of technology from just a supporting one (often called IT support) to a pivotal one in innovating the financial industry leading to different consumer, business and regulatory implications (Alt, Beck & Smits 2018; Arner, Barberis & Buckley 2016; Schueffel 2016). Being an unprecedented FinTech application, Open Banking can potentially create profound change with significant implications to consumers and the industry, but its success is yet to be seen and evidenced.

This research focuses on investigating and understanding the adoption of Open Banking from a consumer's perspective. Since Open Banking is concerned with transforming some of the consumers' banking practices to achieve consumer fairness, understanding this from a consumer perspective will be a reasonable starting point by which to illuminate insights in other areas. Open Banking is a novel domain and to the best of the author's knowledge no

academic research such as this has been carried out thus far. This study takes the theoretical route of applying a technology adoption model. To cater to a financial technology context, it also integrates trust and risk theories in a systematic and structural way. Furthermore, it adopts a financial lens to consider the effect of financial literacy in the adoption process. It contributes to the adoption literature by empirically extending an adoption model to a new domain (Open Banking), as well as advancing the insights gained by providing an integrated adoption model for a modern financial technology setting.

1.2 Open Banking as an Innovation

Innovation is widely accepted as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers 1962; 2003, p. 12). Also it is characterised by "the technological development of an invention combined with the market introduction to end users through adoption and diffusion" (Garcia & Calantone 2002). While Open Banking is a new idea that falls into the innovation definition, it will only be beneficial to more specifically classify it as to what nature and type of innovation it belongs to, in order to draw reference from and provide insights to the relevant domains. There are usually four types of innovation defined by the outcome or result that the innovation will bring, namely, product, service, process and technical (Baregheh, Rowley & Sambrook 2009). Open Banking uses application programming interface (API) which is a technology standard to allow different software to interact and exchange data easily (Fingleton Associates 2014)[1]. It is expected to be a "game changer" (Eyers 2018a, p. 6) that will revolutionise the way financial services are offered (PWC Australia 2018). Accordingly, Open Banking is considered to be a technology innovation in nature and a service innovation in outcome, for it is an invention based on a new technology (API), that has the potential to change existing banking practices and is expected to progress through a process of adoption and diffusion among consumers (Dynes 2018; Manthorpe 2018).

[1] To participate in an API, participants need to share the same standard. A simple example of use of API is ordering, tracking and paying a taxi – where taxi company, Google map and bank use different software but API works at the back to allow exchange of information (UK Government 2018).

1.2.1 Open Banking defined

To promote consumer fairness and competition, many governments act as the key driving force for Open Banking implementations. A number of definitions for Open Banking exist, predominantly provided by regulatory authorities with varying emphases. Some definitions emphasise the technical and institutional aspects (Hong Kong Monetary Authority 2018a) while some define it from a consumer perspective focusing on the generic benefits of access to and control of data (Australian Government 2017; UK Government 2018). To incorporate the essence of this new technology and its implications, this study defines Open Banking as *the financial technology innovation enabled by a common technology standard whereby consumers allow financial services providers to access and aggregate their financial information for wider and more competitive choices of financial management*.

1.2.2 How Open Banking works

Fig. 1.1 graphically explains the relationship between a consumer and banks, before and after Open Banking. By giving consent to Open Banking, consumers can pick the types of financial or transaction information currently residing in different banks and share with the financial institution that s/he desires to, even though s/he may not have a relationship with it. In return that financial institution can assess based on the consumer's aggregated and complete financial picture to give him/her competitive and tailored offers. As Open Banking facilitates information exchange, it can be further leveraged for enabling transactions and switching accounts between financial institutions.

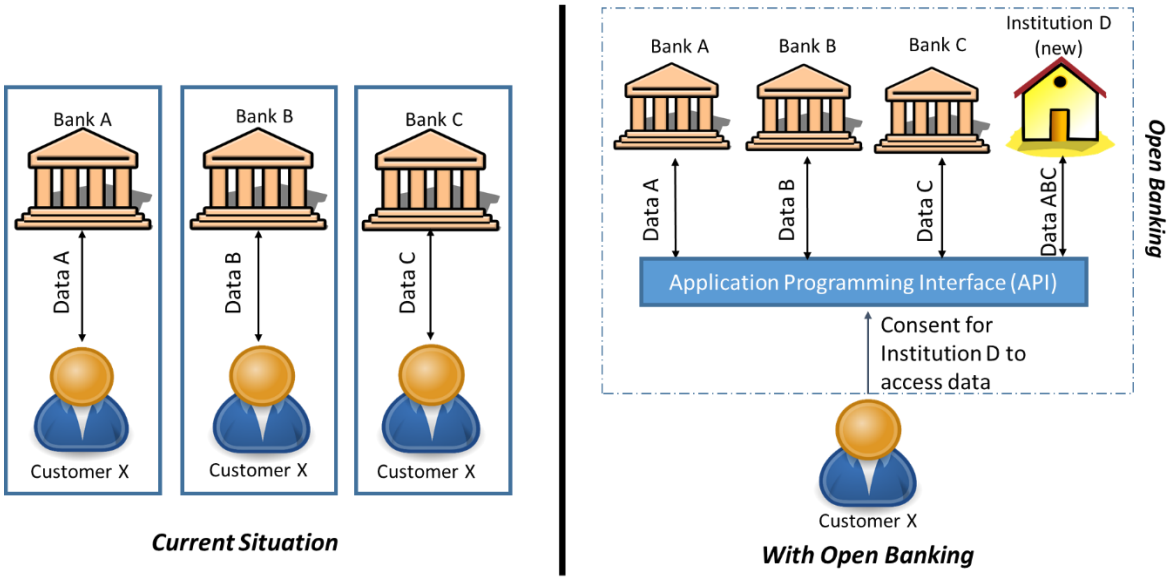


Figure 1. 1 How Open Banking works

Source: developed by the author for this research

1.2.3 The implications for consumers and banks

In short, Open Banking challenges existing data ownership practice and seeks to pass back the control of financial data to consumers. It is widely expected that its adoption can ultimately reshape consumer banking behaviour and the competitive landscape (Brodsky & Oakes 2017; Kehoe 2019; Mark 2018; PWC Australia 2018).

To consumers, since it is easier than ever to obtain and compare competitive information, prices and offers would become more transparent (Eyers 2018d). Time and effort for account switching would be less. They have access to a wider choice of financial institutions on a self-serviced platform. Therefore the key impacts of Open Banking to consumers will be on their behaviour in choosing a product and financial institution, as well as their consumer loyalty. However, these benefits hinge upon data being processed by Open Banking which also raises data privacy and security concerns (Dynes 2018; Eyers 2018e; Riley 2019). Even though in the consent process consumers do not need to release their login credentials, they need to rely on the API provider (whom they may not necessarily be familiar with) in accessing, handling and sharing their information. Such concerns were also confirmed in a survey in the UK whereby only 13% of the respondents were comfortable allowing a third

party to access their financial data despite 63% of them thinking Open Banking services were unique (Dynes 2018).

To the industry, the first challenge Open Banking casts is on their way of managing product competitiveness and customer relationships, with both threats and opportunities presented (Riley 2018). The early launch in the UK has already prompted banks to react (Eyers 2018c). A report from the UK shows that 15%-20% of customers can potentially be attracted by disruptors in an Open Banking environment, and they are the key customer group: typically younger and more affluent contributing to 45% of bank profits (Swinton & Roma 2018a). That said, banks can leverage this new mode of interaction to innovate in product design, customer interaction and distribution (Brodsky & Oakes 2017; PWC Australia 2018; Swinton & Roma 2018b) to capture the opportunities arisen.

The second challenge is on banks' data advantage (Shields 2018; Yeates 2020). As the big banks traditionally own the most data and thus may best assess the customer's needs, this creates an information asymmetry symptom leading to unfair competitive advantage (Larsson 2018). With Open Banking, new entrants, referred as neobanks (Fleeting 2019), can participate on the same level playing field and compete with traditional banks using innovative products and services. Consequently, there will be more intense competition, and the market landscape and dynamics are expected to change (Eyers 2018b; Swinton & Roma 2018b).

1.2.4 The implications for governments and societies

Open Banking is a government initiative to reform the banking industry and enhance consumer fairness. After the global financial crisis in 2008 the industry has revealed many of its deficiencies including deteriorating trust, lack of competition and insufficient governance (Arner, Barberis & Buckley 2016; Crotty 2009; Dewatripont 2010). In the midst of an outcry for improving consumer fairness and industry competition, the UK government commissioned a review (Fingleton Associates 2014) into how to provide greater access of data using the API technology in order to achieve better consumer and competition outcomes. Since then internationally many governments joined force to actively investigate into the implementation of Open Banking, including Australia, EU, Canada, US, Japan, Hong Kong and Singapore (Badour & Presta 2018). While their objectives are consistent, their

implementation approaches and their assumptions of what would make Open Banking a success vary. Appendix A shows a summary of the different government approaches. On one end, a government driven approach (represented by UK and Australia) mandates the scope, the participation of financial institutions, a single operation standard and a centralized accreditation system of participants. On the other end, an industry-led, or organic approach (represented by Singapore and Hong Kong) encourages financial institutions to work out their own standard(s), their pace of joining and their scope of deployment. The government-led approach believes that with a standardized Open Banking protocol, it will greatly help consumers to trust and adopt Open Banking; whereas the industry-led approach confides that leaving the details to industry would encourage more market-driven products and allow faster implementation and adoption.

Currently the governments are observing and learning from each other (Littlejohn 2019). Therefore the success or failure, as well as the factors leading to it, of Open Banking will not only cast local but also international implications as to how governments should regulate this new way of banking. Moreover with Open Banking being a new way of providing financial services, it can be expected that regulators will also need to adjust the related policies, for example, consumer data rights, data security, banking industry practice, competition etc (Eyers 2018e; Kehoe 2019).

Besides, Open Banking may give wider implications beyond the banking industry to the governments. Some progressive government like Australia has made it clear that Open Banking is the first application of open data concept in the banking industry, and the same concept will be further applied to energy, insurance and telecommunication industries to achieve the same purpose of consumer fairness and promoting competitions (Australian Government 2017; Kehoe 2019; Mark 2018). OECD governments promote open government by extending the open data application to public sector hopefully to achieve a more transparent, efficient government (OECD 2020). In fact the traction for understanding the adoption of open data is gaining but understanding is still scarce (Janssen, Charalabidis & Zuiderwijk 2012; Zuiderwijk, Janssen & Dwivedi 2015). Therefore the learnings from Open Banking may also give governments a broader implication of how open data can be applied in other sectors.

To the society, Open Banking presents a new way of allowing consumers to take control of and use their data for better interest and outcome. It can be envisaged that once consumers accept the use of sharing their data at their consent and find they are opened up to better choices, they will be taken to a different level of education and expectation about their data rights and trust towards open data. They may expect other service providers in the society to do the same and the society may eventually migrate into an open data society, which has the benefits of a more efficient government, better participation of citizens, more innovations and greater economic opportunities (Charalabidis et al. 2018). As such the Open Banking story gives a pivotal foresight into how the society may move into a new data economy and potentially benefit.

1.3 Research Problem, Question and Objectives

Open Banking can potentially create profound change to the consumers and the financial sector. There are many industry reports and analyses on the topic showing that traction is gaining and there is a pressing need to understand this by the industry. However on the academic side, there are only a handful of discussions, mainly focussed on its strategic implications (Krivoruchko & Lopatin 2018; Passi 2018; Zachariadis & Ozcan 2017). There is no empirical understanding or validation of theories in this new context. The only lateral reference from other sectors is an adoption study for open government which refers to the sharing of public sector data (Zuiderwijk, Janssen & Dwivedi 2015). The uniqueness of Open Banking involving the sharing of data using an unprecedented method in a financial context means that existing models may not work adequately to explain its phenomenon. This research aims to address the research problem of lack of an applicable model to understand the adoption of Open Banking. Specifically, it seeks to answer the following research question:

What are the key factors of consumers' adoption for Open Banking and how do the factors affect the adoption?

In the later literature review section, it will reveal that to answer the factors that are relevant to an Open Banking adoption, it is required to build the premise on technology adoption theories integrated with other factors. Risk is inseparable from financial technologies (Featherman & Pavlou 2003; Pavlou 2003) and it affects adoption decisions (Ram 1987).

Where risk exists, trust is a counter factor to be considered (Jøsang & Presti 2004). As Open Banking involves both technology and finances, and at the same time it may be provided by unfamiliar entities, the risk and trust concerns are of particular interest to the adoption decision. Also the financial nature of Open Banking sets it apart from just a technology innovation and financial literacy has drawn increasing support to explain financial related decisions (Lusardi & Mitchell 2011b). Therefore, considering these factors will help answering the research question and accomplishing the following objectives:

1. To examine how and to what extent the constructs from adoption theories empirically explain and predict the adoption of Open Banking; and
2. To further integrate and understand the roles of risk, trust and financial literacy in the adoption of Open Banking as a financial technology innovation.

1.4 Contributions of the Study

To answer the research question, this study applies a technology adoption model UTAUT (unified theory of acceptance and use of technology) (Venkatesh et al. 2003) to understand what factors drive usage intention of Open Banking. To enrich the understanding specifically for the financial technology context, it structurally integrates theories of perceived risk, initial trust and financial literacy in the model. The empirical findings suggest that performance expectancy, effort expectancy, social influence and perceived risk are directly influential to usage intention. While performance expectancy is the predominant factor, social influence has a strong mediating effect through performance expectancy to affect usage intention, making it the second most important by total effect. Initial trust, although not a significant direct factor, plays a critical and multi-pronged effect. It can alleviate perceived risk and also positively reinforces performance expectancy and effort expectancy. On the other hand, effort expectancy can also mitigate perceived risk. Furthermore, financial literacy has a scepticism effect on initial trust i.e. the higher the financial literacy, the lower the initial trust towards Open Banking.

Theoretically, this study contributes by providing an empirically-based understanding of Open Banking. It applies an established adoption model and structurally extends it by integrating other relevant theories. While key adoption theories like UTAUT and TAM (technology acceptance model) (Davis 1986) have been widely used in explaining innovation

adoptions in different contexts (e.g. Eid 2009; Faaeq, Alqasa & Al-Matari 2015; Kaushik & Rahman 2015; Kijsanayotin, Pannarunothai & Speedie 2009; Marques, Villate & Carvalho 2011), there is no extant adoption research about Open Banking. The results of this study show that UTAUT and its constructs are applicable in explaining and predicting the usage intention of this new domain.

In addition, the model has integrated perceived risk, initial trust and financial literacy to enhance the understanding of adopting Open Banking as a financial technology innovation. Indeed, with the much increased complexity of technology, developing a more focused and context-specific understanding is an important factor to advance in information systems (IS) research (Lancelot Miltgen, Popovič & Oliveira 2013). FinTech is often described as a revolutionary force in the financial sector (Gomber et al. 2018; Puschmann 2017) and its characteristics present needs and opportunities to go beyond the established adoption factors. The two aspects of it, namely finance and technology, bear double risk concerns to adopters. The issue is more complex when the question of trust comes into the picture considering who provides the service. While there is abundant research explaining the adoption of e-services, internet banking and mobile banking (e.g. Kaushik & Rahman 2015; Rahi, Abd.Ghani & Hafaz Ngah 2019; Zhou, Lu & Wang 2010), risk and trust are not always considered. In particular initial trust is a more relevant theory to technology innovation where consumers cannot rely on experience but various cues to form trust (Kim, G, Shin & Lee 2009). Referencing the extant research of mobile banking studies, it shows there is a lack of structural and systematic approach to incorporating risk and initial trust in adoption models. Furthermore, financial literacy has not been explored in extant research as a possible factor for adoptions that may lead to a change in financial behaviour. This study demonstrates a structural approach to integrate perceived risk, initial trust and financial literacy in an adoption model for a modern financial technology context. Their interacting relationships with UTAUT constructs bring fresh and interesting insights for future research. It not only enriches the IS adoption literature, but also advances the knowledge by bringing originality and integrated understanding towards financial technology adoptions.

On the practical side, by understanding what drives consumers to adopt Open Banking and the relationship between different determining factors, this research gives valuable and actionable insights for different groups of practitioners. For business managers, understanding the priorities of the adoption factors and consumer implications will help the

formation of business strategies. For example, the dominating importance of performance expectancy means businesses should focus on creating a sharp proposition grounded in the benefits of Open Banking. Since initial trust has a strong and multi-pronged effect on perceived risk, effort expectancy and performance expectancy, business managers should also understand where they stand in consumers' minds for trust and strive to use relevant cues to effectively build initial trust.

For technical developers of Open Banking, this study underscores that effort expectancy has influences on performance expectancy and perceived risk. Therefore their development focus should be on making effortless interaction and seamless interface which will help consumers to think Open Banking is useful and not risky. For marketers, the unexpected and strong effect of social influence, not only directly on usage intention but also on performance expectancy, indicates that they should largely leverage early users' endorsements for marketing and make the benefits easily articulated for effective diffusion.

Lastly, this study provides useful insights for policy makers. The UK has been a forerunner in putting Open Banking into practice by advocating the need for it in 2014 (Fingleton Associates 2014) and piloting the service in 2018 (Wright, G 2018). Since then many markets' monetary regulatory authorities have joined force, but their governance and implementation approaches vary based on different considerations of consumer protection versus market flexibility. Some prefer a centralised approach mandated by government and some prefer an organic approach driven by the industry. Appendix A shows a summary and analyses the implications for consumers. The findings from this research provide clarity towards the role and influence of trust and risk on adoption, which will give policy makers better direction on an optimal and effective governance approach.

1.5 Structure of Thesis

The structure of this thesis is organised as follows:

Chapter 1 (this chapter) – has provided a background of this research and introduced what Open Banking is and its implications. The research questions and contributions are drawn.

Chapter 2 – provides a literature review whereby the concerned theories and related literature will be discussed. While it explains in detail the theoretical underpinning of this research and the justifications for choosing UTAUT as the core theory under study, it also highlights the gaps observed and logically deduce a structure for integrating risk, trust and financial-related factors in the study.

Chapter 3 – based on the theoretical ground, it extends into the research framework. The constructs and hypotheses are discussed including their direct, mediating and moderating relationships. The conceptual model is presented.

Chapter 4 – this chapter discusses the methodology to achieve the research objectives. The choice of quantitative method is explained. With defined constructs it reveals how to operationalise the scales and items. The design of an online survey, data collection and data analysis approach using SEM-PLS are also justified.

Chapter 5 – this chapter reveals the data analysis results. Measurement model and structural model are robustly validated following the established guidelines. The result of each hypothesis as well as the new relationships identified are discussed in detail. The final model is presented.

Chapter 6 – provides a concluding discussion focusing on drawing contributions and implications for both academe and practice. Limitations of this research are noted and future research directions proposed.

Chapter 2 Literature Review

This research is underpinned by four domains of theories – technology adoption, perceived risk, initial trust and financial literacy. To answer the first research question of what drives the adoption of Open Banking, the chapter will first review the relevant technology adoption theories and explain the choice of UTAUT as the suitable core theory in this research. As Open Banking is a financial technology innovation with inherent risk perceived, the discussion will continue to include the need for adding perceived risk in the adoption model. The review of perceived risk literature will argue that the discussion of perceived risk is not

complete without considering trust; therefore literature on trust will be reviewed. To validate if the joint consideration of risk and trust is a common approach, mobile phone banking studies are drawn as comparable references and a research gap is observed in systematically structuring perceived risk and trust in adoption studies. Finally, as Open Banking is a technology innovation that may affect financial decision behaviour, financial literacy is brought in for discussion. This interlinking approach to the nature of Open Banking between domains will explain step-by-step why apart from adoption theories, the other three domains are needed. The inclusion of them will answer the second research question about further understanding the roles of risk, trust and financial literacy in the adoption of Open Banking.

2.1 Technology Adoption Theories

This section will give an account of the technology adoption theories in relation to innovation and their existence to explain diffusion. The widely used models, TAM (technology acceptance model) (Davis 1986), UTAUT (unified theory of acceptance and use of technology) (Venkatesh et al. 2003) and TTF (task-technology fit) (Goodhue 1995; Goodhue & Thompson 1995) will be discussed. The choice of UTAUT for use in this research will also be rationalised.

2.1.1 Innovation

Innovation is generally defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers 1962; 2003, p. 12). Innovation can create significant change to individuals, organisations and society (Baregheh, Rowley & Sambrook 2009). However, people do not simply take any innovation and adopt it – innovation is in fact characterised by a lot more failures than successes (Ram 1989; Ram & Sheth 1989). The failure to adopt innovation may present tangible and intangible cost to individuals (e.g. lack of an efficient process), organisations (e.g. R&D cost, lack of competitiveness) and societies (e.g. lack of efficiency or economic advancement). As such innovation adoption has always been a keen interest to both academics and practitioners. In particular, understanding the decision making process and what factors drive adoption within a specific context is valuable, as it will not only help to understand if an innovation will lead to an adoption, but also how to make it successfully adopted.

2.1.2 Diffusion of innovations (IDT)

A large part of the innovation adoption theories can be traced back to the concept of diffusion. In analysing why certain innovations were successfully deployed to a society group and some not, Rogers established the innovation diffusion theory (IDT) that points out an important concept – diffusion, which is "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 1962; 2003, p. 5). By this definition, diffusion involves different elements: the innovation attributes (e.g. relative advantage, complexity etc.), communication channels, time and societal factors (e.g. social structure, social norms etc.). Typically diffusion will go through an S-shaped curve before reaching the critical mass. IDT has laid a strong foundation which becomes one of the important roots for subsequent adoption theories. While it depicts and focuses on a process, the starting point is adoption – the decision to make full use of the innovation. This makes scholars interested in understanding what drives adoption.

Though innovation is not equivalent to technology, they are quite inseparable as technology plays a critical role in delivering innovation (Dahlin & Behrens 2005; Garcia & Calantone 2002). Garcia and Calantone point out that innovation is characterised by the technological development of an invention combined with the market introduction to end users through adoption and diffusion. In the last few decades different IS adoption theories like UTAUT (Venkatesh et al. 2003) and TAM (Davis 1986) have been widely used in investigating and explaining innovation adoptions in various contexts (e.g. Faaeq, Alqasa & Al-Matari 2015; Kijsanayotin, Pannarunothai & Speedie 2009; Marques, Villate & Carvalho 2011; Murphy 2016; Samar et al. 2018).

While UTAUT and TAM focus on individual's perception about the technology to explain the usage intention and actual use, task-technology fit (TTF) argues that there is a lack of perspective from whether the technology fits the task and such fit will affect utilization (Goodhue 1995; Goodhue & Thompson 1995). As this view is complementary rather than conflicting to adoption models, some studies start to integrate TTF into UTAUT or TAM in explaining technology adoptions (Dishaw & Strong 1999; Zhou, Lu & Wang 2010). These popular models will be discussed below.

2.1.3 Technology acceptance model (TAM)

TAM (Davis 1986, 1989; Davis, Bagozzi & Warshaw 1989) introduced two important constructs, namely, perceived usefulness and perceived ease of use. Similar to Rogers' relative advantage, perceived usefulness is defined as a user's subjective belief that using a specific application will increase his/her job performance. Comparable to Rogers' complexity, perceived ease of use refers to the degree of effort which the user expects the application would incur. Both constructs are grounded in theory of reasoned action (TRA) (Ajzen 1980), and theorised to affect attitude of usage which in turn affects intention to use and actual usage. TAM empirically finds that both constructs have a significant influence on usage attitude with perceived usefulness having a greater impact. TAM advances the knowledge on the specific factors leading to adoption.

2.1.4 Unified theory of acceptance and use of technology (UTAUT)

TAM does not include TRA's subjective norm as a determinant of usage intention. Subjective norm refers to the user's perceived expectations from the referent groups to use the application and his/her motivation to comply (Ajzen 1980). Besides, the theory of planned behaviour (TPB) (Ajzen 1991) extends from TRA to include perceived behavioural control, which is the degree that an individual believes that s/he can control the behaviour to happen and is characterised by the resources and support that s/he perceives. As the adoption of IT systems often involves an organisational context, these factors are indeed relevant. UTAUT (Venkatesh et al. 2003) attempts to fill in these considerations. The model has three antecedents to usage intention: performance expectancy (similar to relative advantage of IDT and perceived usefulness of TAM), effort expectancy (similar to complexity of IDT and ease of use of TAM) and social influence. Social influence is defined as the degree to which an individual perceives that important others believe he/she should use the system, which is an echo to subjective norm. Usage intention and facilitating conditions are direct determinants to usage behaviour. Defined as the degree to which an individual believes an organisation will provide support to the use of the system, facilitating conditions echoes perceived behavioural control. Moderators that affect the relationship between different constructs and behavioural intention include gender, age, experience and voluntariness of use. UTAUT has made a notable contribution by extensively comparing 8 existing models that attempt to explain

adoption and synthesised them into a definitive, integrated model with strong empirical support.

2.1.5 Task-technology fit (TTF) and its integration into technology adoption models

The original theoretical intention of TTF (Goodhue 1995; Goodhue & Thompson 1995) is to explain user evaluation of information systems. It focuses on the degree to which the system can match the task needs, where task characteristics and technology characteristics are two antecedents posited to affect task-technology fit. The proposition further proceeds that better task-technology fit will lead to better performance impact and higher utilization. As the model was intended for evaluation purpose, the author(s) suggested very specific measures under each construct to suit the particular system it tested - for example, data quality, locatability, authorization etc. are some of the eight factors in the task-technology fit construct. While the empirical results support task-technology fit will influence performance impact, they do not support the construct will directly lead to utilization. This finding is rationalized in a way that from task-technology fit to utilization there are yet other antecedents like perceived usefulness. Task-technology fit affects perceived usefulness which in turn is also affected by other factors like social norms, habits etc. to affect utilization. Nonetheless it provides a complimentary view to a predominantly perception perspective in technology adoptions and it makes logical sense to argue that users' adoption is not only determined by their perception about the technology but also the fit of the technology into their tasks (Dishaw & Strong 1999; Zhou, Lu & Wang 2010). The studies consistently succeed to prove that task-technology influences performance expectancy (Ahmed et al. 2017; Oliveira et al. 2014; Tarhini et al. 2016; Zhou, Lu & Wang 2010) but some do not support the point of task-technology fit is a direct determinant to adoption (i.e. it only acts through performance expectancy) (Oliveira et al. 2014).

2.1.6 The choice of UTAUT for this research

There are other theories that investigate the spread of innovations (Mahajan & Muller 1979; Peres, Muller & Mahajan 2010), such as the Bass model (Bass 1969, 2004) which aims to answer the timing of adoption. Since this research focuses on the question of what rather than when, the factor-oriented theories like UTAUT and TAM are more suitable. Among the widely used models discussed above, UTAUT is preferred based on two reasons. Firstly, it

focuses not only on individual beliefs (perceived usefulness and perceived ease of use) towards an innovation, but also the contextual factor social norms. As IDT points out, a diffusion process involves societal considerations. Its inclusion will provide a wider perspective of how societal factors affect the adoption of Open Banking. Secondly, UTAUT has synthesised different adoption models and is cross-validated with empirical support, so it is well established for explanatory power across many IS adoption domains.

This research will focus on usage intention instead of usage behaviour as a dependent variable. For Open Banking, as it is very new with limited real applications available predominantly in the UK, it is not realistic to measure usage behaviour. It is believed the investigation of usage intention does not affect the integrity of learning, as by TRA and subsequent validations, usage intention is a good predictor of usage behaviour (Ajzen 1980; Davis 1989).

It should also be noted that due to the ever-changing technology, society and human factors involved in the innovation process (Baregheh, Rowley & Sambrook 2009), the body of adoption knowledge remains a dynamic rather than static discussion. UTAUT has an extended version UTAUT2 (Venkatesh, Thong & Xu 2012) to cater for the evolving technology context. The main difference between UTAUT and UTAUT2 is that the latter includes three additional constructs: hedonic motivation, price value and habit, with the objective to better suit the model for a consumer context. Specifically, hedonic motivation is the intrinsic motivation derived by the pleasure of using the technology; price value is the perceived value vs the monetary cost of adopting the technology. Although UTAUT2 comprises more consumer factors in modern settings, they may not be applicable in Open Banking. Hedonic motivation largely depends on the interaction experience and is better to be validated with an actual product (e.g. seeing the real design of screens and flow, which are not available for Open Banking at this stage). Also, this construct is yet to receive consistent support in financial contexts and markets, with some supporting its significance (Alalwan, Dwivedi & Rana 2017; Baptista, Gonçalo & Oliveira 2015; Farah, Hasni & Abbas 2018) and some not (Baptista, Goncalo & Oliveira 2017; Tamilmani et al. 2019). As for price value and habit, they are also not applicable given there is no price model nor habit formed of Open Banking to date. Therefore, this research will use UTAUT in order to focus on the fundamental factors of adoption and their interaction with risk, trust and financial related

factors. This approach also has a benefit of providing a clean, baseline understanding before other factors are added on which could clutter the learnings.

For similar reasons, this study does not extend UTAUT with TTF. Most of the extended studies so far validate that TTF is an extension to explain one of the UTAUT constructs performance expectancy (Goodhue 1995; Lancelot Miltgen, Popovič & Oliveira 2013; Oliveira et al. 2014; Tam & Oliveira 2016; Zhou, Lu & Wang 2010). It also requires very specific measures of the task (banking) and the technology (Open Banking), inclusion of which will either be too broad or too premature and overload the survey. Therefore for the purpose of focusing on the fundamental learnings of adoption, this second level of explanation is not adopted.

2.2 Perceived Risk and Trust

The above discussed the factors considered in technology adoption models but it should be noted that the originality of technology adoption models, and hence their factors, are geared towards an organisational IS context. If a technology is to be used for personal purposes rather than work, the considerations can be different. The nature of Open Banking is a FinTech designed for personal financial purpose and it is logical to believe that individuals may have other considerations beyond those factors in UTAUT.

2.2.1 Perceived risk

Perceived risk has a long history in consumer behaviour research and has been widely examined and confirmed to influence consumer decisions (Jacoby & Kaplan 1972; Mitchell 1992). It refers to the negative consequences that a consumer perceives to be associated in situation of uncertainty (Mitchell 1992). While adoption theories predominantly focus on what drives individuals to adopt, IDT posits that innovation decision can also be an outright rejection that leads to failure to adopt. Indeed, it argues that past diffusion research is often characterised by a pro-innovation bias – innovation is often assumed to be good and should be adopted (Rogers 1962, 2003), resulting in an underestimation of rejection and the rejection reasons.

Innovation resistance model (Ram 1987) subscribes to this pro-innovation bias critique and introduces perceived risk in an adoption context. While most of the attributes in this model are reverse statements of IDT (e.g., the higher the perceived relative disadvantage, the higher the innovation resistance; the lower the perceived compatibility, the higher the innovation resistance), the model hypothesised and subsequently validated perceived risk to be direct antecedent of resistance (Ram 1989; Ram & Sheth 1989). Given its reverse constructs nature, this model is more commonly used as a post-hoc examination when a rejection phenomenon is observed. For example, it was applied to explain why some people reject using mobile and internet banking (Laukkanen 2016). Accordingly, perceived risk is an important counter consideration in adoption. This is especially true for technology innovation which often comes with certain risks. In other words, innovation adopters do not just consider the benefits of an innovation, but also the potential related losses (risk). Indeed, in the financial context, the digitalisation of banking has re-shaped the decision making processes (Pousttchi & Dehnert 2018) and increased the perceived risk in all decision stages (Cunningham, Gerlach & Harper 2005). For instance, in the case of adopting internet banking, consumers may consider that the chance for the loss of personal data that may further lead to financial loss. As such some internet banking studies actively adopt perceived risk as a construct in adoption (Martins, Oliveira & Popovič 2014; Tarhini et al. 2016).

Further, risk components are context-specific. In innovation resistance model (Ram 1989) perceived risk is classified into four components[2]: functional risk, economic risk, social risk and psychological risk. For the internet and mobile environments, other studies have added in privacy risk and security risk to explain e-banking and mobile banking adoption (Chen 2013; Featherman & Pavlou 2003; Littler & Melanthiou 2006; Tseng et al. 2017). The nature of Open Banking means there are risks associated with finance, data security and data sharing, so performance, financial and privacy risks need to be examined closely.

[2] Definition of each component (Ram & Sheth 1989): 1) functional risk: the risk of performance uncertainty 2) economic risk: the risk of economic loss 3) social risk: the fear of social ostracism and ridicule 4) psychological risk: the fear of psychological discomfort.

2.2.2 Knowledge trust versus initial trust

It should be noted that perceived risk does not act in isolation and the discussion of perceived risk will not be complete without considering trust. While perceived risk is the associated negative consequences in situations of uncertainty, trust is the extent to which one party is willing to depend on somebody or something with a feeling of relative security in the context of uncertainty (Jøsang & Presti 2004). This clearly means trust and risk are separate constructs. Additionally, they act in counter effect and the decision to engage in a risk-bearing relationship is a net outcome of both distinct constructs (Jøsang & Presti 2004; Mayer, Davis & Schoorman 1995). For example, consumers may perceive there is high risk of using internet banking that may result in financial loss, but their trust towards a reputable bank may ease this concern and make them willing to adopt it nonetheless.

The traditional view of trust like the knowledge based trust model (Mayer, Davis & Schoorman 1995) argues that trust is built over time and through experience. Initial trust model (McKnight, Cummings & Chervany 1998) proposes a different concept, which differs in a way that "initial trust between parties will not be based on any kind of experience with, or firsthand knowledge of, the other party. Rather, it will be based on an individual's disposition to trust or on institutional cues that enable one person to trust another without first-hand knowledge". The model is comprised of three factors 1) disposition to trust 2) institution-based trust (arisen from guarantees etc.) and 3) cognitive processes (relying on the first impression or cues) to form initial trust.

The nature of innovation means it always involves no prior experience. As such, initial trust has received support in the related research (e.g. Gao & Waechter 2017; Kim, G, Shin & Lee 2009; Oliveira et al. 2014; Zhou 2011). In a mobile banking adoption study (Kim, G, Shin & Lee 2009) the concept is more specifically translated into a model with three attributes: 1) trust propensity: a person's disposition to rely on others; 2) structural assurance: the form of assurance (e.g. contract, regulations, policies) between involved parties in a risk-taking relationship; and 3) firm reputation: the institutional cues and ideas about the reputation of a firm conveyed formally or informally. Given its relevance to innovation, the initial trust model will be adopted for this study.

2.3 Financial Literacy

Finally, Open Banking is a technology that involves financial implications. Accordingly, its usefulness or perceived effort to use will also depend on factors pertaining to the consumers' financial literacy, beyond technology-related factors. Financial literacy is a growing body of research to investigate how it influences one's financial behaviour. It is defined as how well an individual can understand and use personal finance-related information to make decisions (Huston 2010). Key streams of interest on how financial literacy affects financial decisions include investment (Calcagno & Monticone 2015; van Rooij, Lusardi & Alessie 2011b), retirement planning (Lusardi & Mitchell 2009, 2011a; van Rooij, Lusardi & Alessie 2011a), debt management (Gathergood 2012) and financial education (Fernandes, Lynch & Netemeyer 2014; Hoffmann & Otteby 2018; Son & Park 2019). However, to the best of the author's knowledge, there is no adoption literature for financial technologies such as mobile banking and internet banking that has considered financial literacy. As such, the role of financial literacy in affecting financial technologies adoption is an uncharted research territory that may provide interesting insights.

2.4 Findings from Mobile Banking Studies

The above theoretical discussion suggests that to explain the adoption of Open Banking, which is a technological innovation in a financial context, four components – adoption model, perceived risk, initial trust, and financial literacy – should be comprehensively considered. Given the lack of extant research of Open Banking adoption, a literature review of mobile banking adoption is conducted to draw insights, as well as identify gaps and support for the theoretical framework. Mobile banking studies, and specifically those which have included at least one of risk and trust constructs, are chosen as comparable studies based on the reasons outlined below.

Firstly, Open Banking works in a mobile application (app) context. With high smartphone penetration at 80% (Deloitte 2016) and easy download and interactive features, mobile apps have become ubiquitous in daily life. Mobile banking has overtaken internet banking as the most used channel in many countries (Bain & Company 2014). Secondly, the similarity in their nature in both being an app for financial transactions mean they share similar risk considerations such as financial risk and privacy risk. Thirdly, since mobile banking is one of

the latest major technology innovations in the banking industry, related studies will provide more recent insights in consumer considerations for a financial technology.

Table 2.1 compares and contrasts some of these studies in terms of their contexts and the use of constructs in adoption, trust and risk. Consistent with another meta-analysis (Shaikh & Karjaluoto 2015), it can be observed that UTAUT and TAM are popular models. They are largely supportive of explaining adoption, though details of the constructs vary according to the context and objective.

Another observation is, however, that there exists a lack of a consistent and systematic approach in understanding the roles of risk and trust and integrating them in an adoption model. Only a few studies consider both risk and trust as distinct constructs (Chemingui & Ben Lallouna 2013; Farah, Hasni & Abbas 2018; Luo et al. 2010; Sarfaraz 2017), while the rest just consider either one or use one aspect to represent both of them (Yu 2012). As discussed in section 2.2, they are different constructs acting on different premises, so the lack of both may only present a partial picture. Besides, their roles to usage intention are also structured differently in the models. For example, some posit risk as a moderator (Shaikh, Glavee-Geo & Karjaluoto 2018) while others suggest both as direct antecedents to adoption. The lack of a consistent, structural approach may in fact also be a reason for the studies to yield different conclusions in risk and/or trust besides the market factor.

Against this backdrop, this research advocates a more precise and systematic structuring of risk and trust in the study of Open Banking. This may be even more important in Open Banking than in mobile banking because the latter is provided by banks, whereas Open Banking may not necessarily be provided by a recognised bank entity. Moreover, the assurance associated with the governance approach may also affect trust in Open Banking. These will give unprecedented considerations for risk, trust and their roles in adoption.

Lastly, apart from risk and trust, it is also clearly observed that financial literacy has not been considered in the mobile banking adoption studies. This indicates that the prior financial technology studies mostly consider the topic a technology adoption without considering the financial facet of the technology innovation. Therefore, an attempt to explore and understand how financial-related factors may also affect financial technology adoption will be value-adding.

Table 2. 1 Analysis of Mobile Banking Adoption Studies involving Risk and / or Trust

Literature	Context	Theoretical Base	Dependent Variable (R^2)	Adoption Constructs	Risk Constructs	Trust Constructs
Understanding dynamics between initial trust and usage intention of mobile banking (Kim, G, Shin & Lee 2009)	Korean Mobile banking	Initial Trust Model	Usage intention (0.31)	Relative benefits*	N/A	Relative benefits* Personal propensity to trust* Structural assurances* Firm reputation
An empirical investigation of mobile banking adoption: the effect of innovation attributes and knowledge-based trust (Lin 2011)	Taiwan Mobile banking	Innovation Diffusion Theory Knowledge-based Trust	Usage attitude (n/a) Usage intention (n/a)	Perceived relative advantage* Perceived ease of use* Perceived compatibility*	N/A	Perceived competence* Perceived benevolence Perceived integrity*
Extending the understanding of mobile banking adoption: when UTAUT meets TTF and ITM (Oliveira et al. 2014)	Portugal Mobile banking	UTAUT Task Technology Fit Initial Trust Model	Usage intention (0.534) Adoption (0.667)	Performance expectancy* Effort expectancy Social influence Facilitating conditions* Technology characteristics* Task characteristics*	N/A	Personal propensity to trust Structural assurances* Firm reputation*
Consumer adoption vs rejection decisions in seemingly similar service innovations: The case of the internet and mobile banking (Laukkanen 2016)	Finland Mobile banking Internet banking	Innovation Resistance Model	Usage intention (n/a)	(-ve relationship) Usage barrier Value barrier* Tradition barrier* Image barrier*	Risk barrier	N/A
How relevant are risk perceptions, effort and performance expectancy in mobile banking adoption? (Shaikh, Glavee-Geo & Karjaluoto 2018)	Pakistan Mobile banking	UTAUT Theory of Planned Behaviour	Usage attitude (0.38) Usage intention (0.52)	Performance expectancy Effort expectancy*	Perceived risk* (moderator)	N/A
Perceived risk, usage frequency of mobile banking services (Chen 2013)	Taiwan Mobile banking	Innovation Diffusion Theory	Usage attitude (n/a) Usage intention (n/a)	Relative advantage* Compatibility* Complexity* Trialability* Observability*	Financial risk* Performance risk* Time risk* Psychological risk* Privacy risk*	N/A

Table 2.1 Analysis of Mobile Banking Adoption Studies involving Risk and / or Trust (cont.)

Literature	Context	Theoretical Base	Dependent Variable (R^2)	Adoption Constructs	Risk Constructs	Trust Constructs
Mobile banking adoption of the youth market (Akturan & Tezcan 2012)	Turkey Mobile banking	TAM	Usage attitude (0.684) Usage intention (0.529)	Perceived usefulness* Perceived ease of use Perceived benefit*	Social risk* Performance risk* Financial risk Time risk Security risk Privacy risk	N/A
Resistance, motivations, trust and intention to use mobile financial services (Chemingui & Ben Lallouna 2013)	Tunisia Mobile banking	TAM UTAUT Innovation Resistance Theory	Usage intention (n/a)	Relative advantage Compatibility* Trialability* Facilitating conditions Perceived enjoyment* -ve: Usage barrier Value barrier Tradition barrier*	Risk barrier	System quality -> Trust* Trust
Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies: An empirical study of mobile banking services (Luo et al. 2010)	U.S. Mobile banking	UTAUT Initial Trust	Usage intention (0.509)	Performance expectancy*	Performance risk* Financial risk* Time risk* Psychological risk* Social risk Privacy risk* Physical risk Overall risk*	Trust belief Disposition to trust* Structural assurance*
An investigation of consumer acceptance of M-banking (Wessels & Drennan 2010)	Australia Mobile banking	TAM	Usage attitude Usage intention (0.838)	Perceived usefulness* Perceived ease of use Need for interaction Cost* Compatibility*	Perceived risk*	N/A
Factors affecting individuals to adopt mobile banking: Empirical evidence from the UTAUT model (Yu 2012)	Taiwan Mobile banking	UTAUT	Usage intention (0.604) Usage behaviour (0.651)	Performance expectancy* Effort expectancy Social influence* Facilitating conditions Perceived financial cost* Perceived self-efficacy	Perceived credibility*	Perceived credibility*

**significant constructs ($p<0.05$). For details of the relationship please refer to the model in the respective literature*

Table 2.1 Analysis of Mobile Banking Adoption Studies involving Risk and / or Trust (cont.)

Literature	Context	Theoretical Base	Dependent Variable (R^2)	Adoption Constructs	Risk Constructs	Trust Constructs
Unified theory of acceptance and use of technology (UTAUT) model – mobile banking (Sarfaraz 2017)	Jordan Mobile banking	UTAUT	Usage intention (0.23)	Performance expectancy* Effort expectancy* Social influence	Risk*	Trust
A mobile banking adoption model in the Jordanian market: an integration of TAM with perceived risks and perceived benefits (Mha 2015)	Jordan Mobile banking	TAM	Usage attitude (0.58) Usage intention (0.51)	Perceived ease of use* Perceived usefulness* Perceived benefits*	Performance risk Privacy risk* Social risk Time risk* Financial risk	N/A
Mobile-banking adoption: empirical evidence from the banking sector in Pakistan (Farah, Hasni & Abbas 2018)	Pakistan Mobile banking	UTAUT2	Usage intention (n/a) Usage behaviour (n/a)	Performance expectancy* Effort expectancy* Social influence* Facilitating condition Habit* Hedonic motivation* Perceived value*	Perceived risk	Trust
Factors influencing adoption of mobile banking by Jordanian bank customers: extending UTAUT2 with trust (Alalwan, Dwivedi & Rana 2017)	Jordan Mobile banking	UTAUT2	Usage intention (0.65) Usage behaviour (0.31)	Performance expectancy* Effort expectancy* Social influence Facilitating condition Habit* Hedonic motivation* Price value*	N/A	Trust

**significant constructs ($p<0.05$). For details of the relationship please refer to the model in the respective literature*

2.5 Summary

This chapter discusses four key theories that form the basis for improving understanding of Open Banking adoption. The theories include technology adoption, perceived risk, initial trust and financial literacy. The literature discussion aims at establishing their relevance and importance to understanding adoption of Open Banking. This chapter also draws comparison to mobile banking studies and finds that while financial literacy has not been considered, risk and trust constructs warrant a more precise and systematic investigation. The findings reinforce that a structured integration of them into the study model is valuable in filling the extant research gaps. With the appropriate model in each domain drawn, the next chapter will focus on the research framework by defining the constructs and developing hypotheses among them.

Chapter 3 Research Model and Hypotheses Development

The preceding chapter has laid out four key components of the model under research: UTAUT, perceived risk, initial trust and financial literacy. To answer the research question of *What are the key factors of consumers' adoption for Open Banking and how do the factors affect the adoption?*, UTAUT from the technology adoption theories is used. As technology comes with inherent risks and initial trust is a counter consideration to risk for innovations, they are incorporated in the model under study. Lastly, owing to the financial nature of Open Banking, financial literacy is also included in the model to understand how it affects a financial technology adoption. A conceptual framework is illustrated in Fig. 3.1, which outlines the theoretical components of the research and it will expand into the conceptual model under research in Fig. 3.2 after a thorough discussion of each component. As discussed in the literature review, this research advocates a structural and systematic approach to integrate these factors in this study. This chapter will develop the hypotheses and synthesise the constructs into an integrated model in attempting to explain the intention of consumers to use Open Banking.

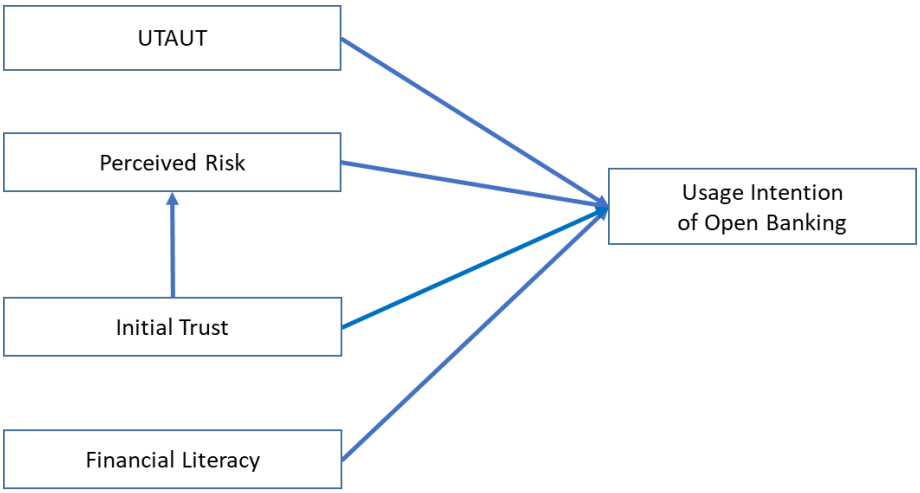


Figure 3. 1 Conceptual Framework

3.1 Performance Expectancy and Usage Intention

Performance expectancy, defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al. 2003), is a direct antecedent to usage intention in UTAUT. Its nature is similar to relative advantage in IDT (Rogers 1962, 2003) and perceived usefulness in TAM (Davis 1986), which describes the benefits that the adopter perceives to gain from the innovation. It is found to be a consistent and predominant factor affecting adoption in most internet banking and mobile banking studies (Lin 2011; Oliveira et al. 2014; Tarhini et al. 2016; Wessels & Drennan 2010; Yu 2012). As innovation adoption means a change in behaviour, naturally there must be perceived benefits to justify the change. With Open Banking, a consumer can obtain the benefits of getting a tailored and better offer, saving comparison effort, performing transactions and switching to other institutions easily. Value-added services like aggregating one's financial position and obtaining recommendations can also be obtained. The scope of application as to what kind of products will be included in Open Banking will also affect the perceived benefits of using it. Therefore it is expected that if people perceive Open Banking to be useful, they will have higher intention to adopt it. Based on discussion above it is hypothesised that:

H1: Performance expectancy positively influences the usage intention of Open Banking.

3.2 Effort Expectancy and Usage Intention

UTAUT defines effort expectancy as "the degree of ease associated with the use of the system" (Venkatesh et al. 2003) and a direct antecedent to usage intention. It is similar to perceived ease of use in TAM (Davis 1986) and complexity in IDT (Rogers 1962, 2003). In this era of fast and rapidly developing technology with abundant apps and software available for different purposes in everyday life, naturally, which one is easier to use will constitute an adoption decision. But interestingly findings of this construct in adoption studies are not consistent, with only a portion finding it significant to usage intention (Chemingui & Ben Lallouna 2013; Farah, Hasni & Abbas 2018; Lin 2011; Shaikh, Glavee-Geo & Karjaluoto 2018) and a few finding it almost as important as performance expectancy (Alalwan, Dwivedi & Rana 2017; Martins, Oliveira & Popovič 2014). The inconclusive findings suggest effort expectancy is a comfort factor that is driven by the context. For example, a mobile banking study showing effort expectancy to be a non-significant factor to usage intention explains the phenomenon by the familiarity of using mobile phones in Portugal, whereby ease of use is expected (Oliveira et al. 2014); whereas another study which finds effort expectancy the most significant factor to usage intention in Pakistan attributes the finding to a developing country context (Shaikh, Glavee-Geo & Karjaluoto 2018). Open Banking is no doubt a new concept to the adopters; and its newness should present a sense of discomfort. How much effort is required for them to learn, navigate and use the functions are effort expectancy considerations. In particular, some governments lead the development of a single operation standard for data standard, security and functionality, while others are open to multiple operation standards (see Appendix A). It can be anticipated that a single operation standard would mean less effort is required for consumers to understand Open Banking, and the interoperability between providers would mean more ease of use to consumers. In this study, it is expected that higher effort expectancy (less effort) will increase the usage intention. The hypothesis goes as:

H2: Effort expectancy positively influences the usage intention of Open Banking.

3.3 Social Influence and Usage Intention

Social influence is "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al. 2003). It is included and proven to be significant in limited adoptions under review (Farah, Hasni & Abbas 2018; Tarhini et al. 2016; Yu 2012). This may be attributed to the general belief that social influence is not a relevant factor to a personal financial service which involves confidential data (Oliveira et al. 2014). IDT points out that early adopters rely more on their social participation for communication (Rogers 1962, 2003). Given Open Banking is a new concept, there may not be sufficient information readily available and early adopters may rely on their social circle to form usage intention, e.g. how others describe the advantages (or disadvantages) of Open Banking. It is worth preserving this UTAUT construct which is hypothesised to influence the usage intention. Based on this, the hypothesis is:

H3: Social influence positively influences the usage intention of Open Banking.

3.4 Perceived Risk and Usage Intention

In the literature review section 2.2.1, it has been discussed that perceived risk is the perceived negative consequences that a consumer perceives to be associated in situation of uncertainty (Mitchell 1992), and the components of risk very much depends on the nature and context. For Open Banking, it requires consumers to release data to a third party platform to manage financials. It is not difficult to imagine that, there will be performance risk (will Open Banking perform properly?), financial risk (will I lose money due to any fault or error?), and data privacy risk (will the data be technically secured and not leaked to others on an unwilling basis?). Prior e-banking service studies support the use of these facets, indicating that financial risk, performance risk and privacy risk are dominant facets (Chen 2013; Featherman & Pavlou 2003; Luo et al. 2010). Perceived risk is found to have direct negative impact on usage intention of internet banking and mobile banking (Chen 2013; Luo et al. 2010; Martins, Oliveira & Popovič 2014; Wessels & Drennan 2010). For Open Banking, it is also hypothesised that higher perceived risk will lower the usage intention. Therefore the hypothesis is:

H4: Perceived risk negatively influences usage intention of Open Banking.

3.5 Initial Trust and Usage Intention

The initial trust model applied in mobile banking (Kim, G, Shin & Lee 2009; Oliveira et al. 2014) posits that trust propensity, structural assurance and firm reputation are antecedents to initial trust which influences usage intention. Trust propensity refers to a person's disposition to rely on others to partake various actions (Kim, G, Shin & Lee 2009). In Open Banking, it is expected that if a person has more trust towards technology, s/he will be more likely to adopt Open Banking. For structural assurances, it means assurance in the form of agreements, regulations, policies, laws, guarantees that can enhance initial trust (Kim, G, Shin & Lee 2009). It gives peace of mind to adopters even when they have no experience with the innovation. Open Banking has been an initiative of many governments, some of which like the UK even drive the standards, licensing system and regulations (see Appendix A) in order to instil more trust in consumers towards Open Banking. The third antecedent, firm reputation, refers to people's perception towards the service provider and the derived assumptions of reliability when there is no prior experience to rely on (Kim, G, Shin & Lee 2009). In Open Banking this may be even more important as the provider can be a non-bank entity with which consumers do not have prior experience. Initial trust is found to be a significant factor to usage intention of mobile banking (Oliveira et al. 2014). Similarly, it can be expected that if there is more initial trust towards Open Banking, the usage intention will be higher. Based on this, it is hypothesised that:

H5: Initial trust positively influences usage intention of Open Banking.

3.6 Initial Trust and Perceived Risk

As discussed in the literature review section 2.2, initial trust and perceived risk are distinct constructs and they work in tandem to affect decision (Jøsang & Presti 2004; Mayer, Davis & Schoorman 1995); however, there is lack of clarity for their separate but co-existing roles in the studies reviewed. Additionally, the directionality of their causal relationship is often not clearly established (Pavlou 2003). For a long time there have been different views of scholars on their relationship – whether trust is an antecedent of risk, the same as risk, or a by-product of risk (Kim, DJ, Ferrin & Rao 2008). In the study which investigates trust and risk in adoption of

electronic commerce, Pavlou (2003) points out that for trust to take effect, risk must exist at the beginning. The study proves that trust is a significant antecedent of perceived risk, but the reverse is not true. It gives interesting insights in finding that trust can actually alleviate perceived risk, but perceived risk has no effect on trust. This supports the conceptual argument that "perceived risk is a necessary antecedent for trust to be operative and an outcome of trust building is a reduction in the perceived risk of the transaction or relationship" (Mitchell 1999). For Open Banking, even though there may be perceived risk of using it, it is hypothesised that the initial trust driven by the provider (firm reputation), government policies (structural assurance) and personal disposition to trust (propensity to trust) can all reduce the feeling of uncertainty. Therefore the hypothesis for initial trust in relation to perceived risk is:

H6: Initial trust negatively influences perceived risk.

3.7 Initial Trust and Performance Expectancy

Performance expectancy is how one perceives the usefulness of an innovation. As it is a perception, it can be subjectively affected by other factors like the trust towards the provider or the technology. Initial trust, to some extent, acts as a subjective guarantee of the benefits or usefulness that the consumer is expecting to receive (Luo et al. 2010). Though it is a relationship less explored, it is proven in a few e-service studies that trust can reinforce performance expectancy or perceived usefulness (Gao & Waechter 2017; Pavlou 2003). For Open Banking, as it is very new and there is no prior knowledge of its usefulness, it is believed that initial trust is a factor in influencing performance expectancy. For example, if Open Banking is provided by a trusted bank, consumers may have the assumption that it is more useful as compared to a provider that they do not know. Therefore it is hypothesised that:

H7: Initial trust positively affects performance expectancy.

3.8 Initial Trust and Effort Expectancy

Similar to performance expectancy, effort expectancy is also a perception which can be affected by the trust factor. Trust reduces the need for consumers to understand, monitor and control the situation (Pavlou 2003). It is reasonable to believe that if there is a high level of initial trust, the

potential adopter will perceive it is easy to use an e-service (Gao & Waechter 2017). In the Open Banking context, if there is assurance from the government and/or industry, they may perceive lower uncertainty and greater ease of use. On the contrary, if the provider is not known or trusted, they may be more cautious and the effort to understand the implication of each step for better protection will be increased. As such, it is hypothesised that:

H8: Initial trust positively affects effort expectancy.

3.9 Effort Expectancy and Perceived Risk

Perceived risk exists when there is uncertainty. A logical deduction is that if something is easy to use, it removes some of the uncertainty feeling and the perceived risk will be less. A similar finding is discussed in the context of mobile services (Wang, Lin & Luarn 2006) where the ease of use of mobile services is found to positively affect the perceived credibility, that is, the belief that the service is free of risks. Empirically it is found effort expectancy can reduce the perceived risk of adopting internet banking (Martins, Oliveira & Popovič 2014). It follows that if Open Banking is perceived as easy to use (higher effort expectancy), the perceived uncertainty of how the app may perform and how data is handled will be reduced, and hence the perceived risk will be less. Therefore the hypothesis is:

H9: Effort expectancy negatively affects perceived risk.

3.10 Effort Expectancy and Performance Expectancy

In TAM, ease of use is found a direct antecedent not only to usage attitude, but also to perceived usefulness (Davis 1986, 1989; Davis, Bagozzi & Warshaw 1989). In other words, feeling easy to use something will reinforce that something is useful. The relationship has been confirmed in some mobile banking and internet banking studies using TAM (Kesharwani & Singh Bisht 2012; Pavlou 2003) and UTAUT (Alalwan, Dwivedi & Rana 2017; Zhou, Lu & Wang 2010). For Open Banking, if it takes less effort to perform the designed functions like comparing offers and switching between financial institutions, it should also make consumers feel it is more useful. Hence it is hypothesised that:

H10: Effort expectancy positively influences performance expectancy.

3.11 Financial Literacy, Performance Expectancy and Effort Expectancy

Financial literacy relates to one's knowledge about understanding and managing finances, and it affects a wide range of financial decisions like retirement planning and stock market participation (Allgood & Walstad 2016; Greenberg & Hershfield 2018; Lusardi & Mitchell 2009; van Rooij, Lusardi & Alessie 2011b). In most studies, financial literacy is posited to have direct effect on the financial decision. For example, people with higher financial literacy will be more prepared in retirement planning (van Rooij, Lusardi & Alessie 2011a), whereas investors with lower financial literacy will be less likely to use a financial advisory service (Calcagno & Monticone 2015). In this study, financial literacy is not about the direct knowledge of Open Banking (what it is and how it works), but rather, the knowledge that sets the context for perceiving and understanding the purpose of Open Banking. Thus, instead of being a direct antecedent, it is hypothesised to be a moderator that strengthens the effects of performance expectancy and effort expectancy on usage intention. For example, Open Banking may display options of saving interest on one's loan. Saving interest is a content rather than the performance expectancy of Open Banking (which should be comparison and displaying options in this case). Even if the same content is displayed and the same performance expectancy is perceived by two different people, the person with higher financial literacy may be more motivated to adopt Open banking than a lower financial literacy person as s/he is more able to comprehend the interest savings content and knows how to associate it with his/her own financial wellbeing. Similarly, if two persons see the same content and perceive the same effort to use Open Banking, the one with higher financial literacy may be more motivated to adopt it as s/he may better link the effort to justify his/her financial benefits. As such the hypotheses for financial literacy are:

H11a: Financial literacy positively moderates the relationship of performance expectancy and usage intention.

H11b: Financial literacy positively moderates the relationship of effort expectancy and usage intention.

3.12 Summary and the Conceptual Model

This chapter has discussed the development of 11 hypotheses for this study. Performance expectancy, effort expectancy, social influences, perceived risk and initial trust are hypothesised to be direct antecedents to usage intention. Moreover, initial trust is hypothesised to have a negative effect on perceived risk but a positive effect on both performance expectancy and effort expectancy. Furthermore, effort expectancy is hypothesised to negatively influence perceived risk but positively influence performance expectancy. Lastly, financial literacy is hypothesised as moderator to performance expectancy and effort expectancy on usage intention. Fig. 3.2 depicts the conceptual model for Open Banking adoption. It is expanded from Fig. 3.1 except financial literacy is no longer posited as a direct antecedent to usage intention but a moderator.

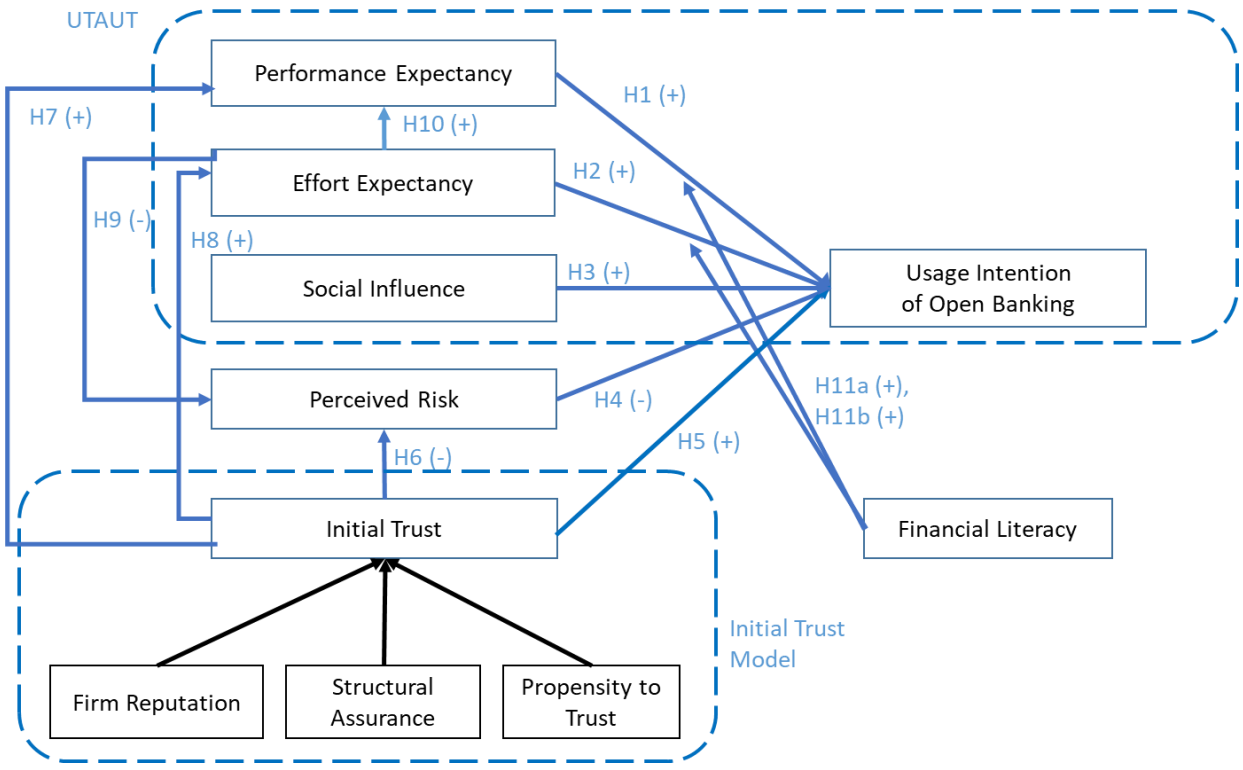


Figure 3. 2 Conceptual Model for Open Banking Adoption

Chapter 4 Research Methodology

Following a literature review of the concerned theories, the preceding chapter presented the research framework including the conceptual model and hypotheses. In this chapter the methodology of the research will be discussed. This research will use quantitative method and the rationale will be explained. Following the establishment of a quantitative approach, the operationalisation of constructs and their measurements will be reviewed. The research process, including the design of survey, sampling and data collection will be elaborated, before data cleaning and data analysis approach conclude this chapter.

4.1 Research Philosophy and the Choice of Quantitative Method

Krauss (Krauss 2005, p. 758) states that “Despite many proposed differences between quantitative and qualitative epistemologies, ultimately, the heart of the quantitative-qualitative "debate" is philosophical, not methodological”. Philosophical assumptions frame the perspective of how a research question should be answered and hence how the study should be carried out. Among different philosophies, the positivist social science philosophy is “an organized method for combining deductive logic with precise empirically observations of individual behaviour in order to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity” (Neuman 2014, p. 97). Positivist social research adopts the lens of science and always employs quantitative methods. Quantitative research seeks to establish, confirm, or validate relationships and to develop generalisations that contribute to theory (Creswell 2014; Hanson & Grimmer 2007; Williams 2011). The concepts and relationships not directly measurable can be studied via a set of variables and advanced statistical analysis (Hair 2014). The research question of this study is to understand the factors and their influence on the usage intention of Open Banking, which is an empirical process of observing a behavioural outcome based on a set of hypothesised relationships. It falls into the field of positivist research philosophy; therefore, using quantitative methods can answer the research question by providing empirical validations to the hypotheses in the model as well as giving statistical support to generalise findings for further applications. In essence, the positive or

negative relationship between different usage factors and the usage intention of Open Banking can be confirmed by observing the behaviour of a respondent group, the impact of each relationship can be quantified, and ultimately the model can be reapplied to a similar context in the future. Within quantitative methods, survey is further chosen for the following reasons. Firstly, survey is statistical in nature and can generate large amounts of first hand data about the research targets' beliefs, opinions and behaviours (Neuman 2014, p. 317). This research aims to obtain primary data from respondents about their views towards Open Banking, and to generalise statistical relationships out of their views. Secondly, from a practical perspective, as Open Banking is a very new concept, there exists no secondary data, nor is an experiment suitable for answering the research question.

4.2 Operationalising the Constructs

In a quantitative research where measurement is key, operationalisation essentially links a conceptual definition to measures that allow a research to observe it empirically (Neuman 2014, p. 207). The conceptual model of this study consists of a dependent variable usage intention as well as 9 constructs originated from 2 models (UTAUT, initial trust model) and 2 scales (perceived risk, financial literacy). While the constructs have been conceptually defined in the hypotheses section, the current section focuses on operationalising them in this study. Where applicable, the items and measurement scale in the original models are adapted; otherwise items are adapted from the literature that has used the model for a relevant context.

4.2.1 Usage intention

This is the dependent variable in the model. It measures the extent to which the respondent intends to use Open Banking. In the original UTAUT model, it is a 3-item scale which measures the behavioural intention including "intend to use", "predict to use" and "plan to use". These 3 items are adapted with a 7-point Likert scale for this study. All Likert scale in this study refers to a scale ranging from strongly disagree (1) to strongly agree (7).

4.2.2 UTAUT constructs

In the UTAUT model there are 3 constructs hypothesised to affect usage intention – performance expectancy, effort expectancy and social influence. Performance expectancy measures the extent to which the respondent think Open Banking will be useful to them in managing finances. Effort expectancy measures the level of ease of use the respondent expects Open Banking will require. The items for these constructs are also adapted from the UTAUT model with a 7-point Likert scale. Social influence gauges the effect of other people around the respondent on the intention to use Open Banking. The original items in UTAUT for this construct is based on an organisational and information system context, therefore questions are asked from the perspective that if the organisation and senior management of the business support the use of the system. Open Banking is designed for individual use in financial management and the influence, if any, will not be coming from senior management or work organisation but rather, the social circle. A study using UTAUT to investigate adoption of mobile banking (Oliveira et al. 2014) has translated the items to suit a consumer context by employing perspectives from the social circle. They are hence more suitable and adapted for this study.

4.2.3 Initial trust constructs

Initial trust is a higher level construct driven by firm reputation, structural assurance and propensity to trust. Firm reputation measures the confidence of the respondent in a firm's name and services. Structural assurance measures how much the respondent think the agreement or any structural format will give protection to the use of Open Banking. As Open Banking is a novel concept to the respondents and much is still evolving on the industry and regulatory level, these two items are tested as perceived firm reputation and perceived structural assurance. In other words, respondents are not asked based on their real knowledge as to who is providing Open Banking and what will be provided on structural assurances, but rather their perception on what will be happening. Propensity to trust measures the personality trait on individual tendency to

trust. This is a negative scale (the higher the score the lower the propensity) and therefore the scale is later on reversed at analysis stage. For these constructs, the original items from the initial trust model and 7-point Likert scale are adapted (Kim, G, Shin & Lee 2009).

4.2.4 Perceived risk

In the literature review it is discussed that perceived risk exists in many forms and is dependent on the context. In an e-services study (Featherman & Pavlou 2003) 7 facets – performance risk, financial risk, time risk, psychological risk, social risk, privacy risk, overall risk – are investigated as reflective variables of perceived risk in the context. Since perceived risk is only one of the 9 constructs in our research model, a full adoption of all 21 items will overload the survey and respondents. Three facets, financial risk, performance risk and privacy risk, along with 10 items are chosen for this study, not only because of their relevance to Open Banking, but also because empirical evidence from the original research indicates that they carry the highest weights of reflecting perceived risk in the e-services context. Unlike the objective of the original literature which is to find out what facets are most relevant to the perceived risk in the context, since the 3 facets have been empirically tested to be most relevant to e-services, they are put on a uni-level scale to represent the total perceived risk of Open Banking. The measurement scales are a mix of Likert scale and semantic differential scale, with a higher rating meaning the perceived risk is higher.

4.2.5 Financial literacy

Financial literacy measures the knowledge of basic financial concepts that a respondent has and is hypothesised to be a moderator in this study. Five questions (Allgood & Walstad 2016) are used to test the respondent's basic understanding on interest, mortgage, savings and investment. This scale has been used in the US National Financial Capability Study (NFCS) as well as financial literacy related studies (Hoffmann & Otteby 2018). Each correct answer to the five

questions scores one point which is then summed up to a total score to reflect one's financial literacy. As such it is an objective (not self-perceived or subjective) measurement.

4.2.6 Refinement of construct items

In the item adaptation process, the challenges of finding the right items to suit the nature of Open Banking as an application used in a consumer context, and the abstraction of it being a concept rather than a concrete product were particularly noted and addressed. The process went through rigorous scrutiny with 3 supervisors, during which options of different scales and wordings, as well as their pros and cons, were carefully deliberated resulting in 7 iterations. For instance, UTAUT was originally used in an organisational context with social influence items like "the senior management of this business has been helpful in the use of the system" (Venkatesh et al. 2003), which is not applicable for Open Banking. Therefore the social influence items are adapted from a mobile banking research project (Oliveira et al. 2014) which is more relevant to a consumer context. Also, the initial trust studies test firm reputation and structural assurance in environments where providers are known. For Open Banking, it is still largely a concept and there is no known provider yet, and even if there is, a specific brand name may create bias towards the trust perception of the concept. Furthermore, in this context there is a network of providers (e.g. data provider, data receiver and data handler etc.) providing the service in tandem instead of a single provider. In view of these issues a generic but precise category name, 'financial data administrators', is used with definition provided. Table 4.1 is the summary of the constructs and measurement items, and the comparison with the source scale is in Appendix B.

Table 4. 1 Constructs and Measurement Items

Construct	**Items used in the study**
Usage Intention (Venkatesh et al. 2003) 7-pt Likert scale	I intend to use Open Banking in the future. I predict I would use Open Banking in the future. I plan to use Open Banking in the future.
Performance Expectancy	I expect to find Open Banking useful in my financial management. Using Open Banking would enable me to accomplish financial tasks more quickly. Using Open Banking would increase my efficiency in financial management. If I would use Open Banking, I increase my chances of getting more competitive banking offers.
Effort Expectancy	I expect that my interaction with Open Banking would be clear and understandable. I expect that it would be easy for me to become skilful at using Open Banking. I expect that I would find Open Banking easy to use. I expect that learning to use Open Banking would be easy for me.
Social Influence (Oliveira et al. 2014)	My friends and family would value the use of Open Banking. I expect that the people that influence me would use Open Banking. I expect that Open Banking would be trendy. I expect that using Open Banking would make me look professional in managing my finances.
Initial Trust (Kim, G, Shin & Lee 2009) 7-pt Likert scale	I expect that Open Banking would always provide accurate financial services. I expect that Open Banking would provide reliable financial services. I expect that Open Banking would always provide secure financial services.
Perceived Firm Reputation	I expect that the financial data administrators (i.e. firms involve in providing and handling my financial data in the process) of Open Banking would have a good reputation. I expect that the financial data administrators of Open Banking would be recognised widely. I expect that the financial data administrators of Open Banking would offer good services.
Perceived Structural Assurance	I expect that the financial data administrators of Open Banking would have a compensation policy for monetary losses that might occur during service usage. I expect that the financial data administrators of Open Banking would have a policy on personal information. I expect that the financial data administrators of Open Banking would have a policy on the protection of transaction data. I expect that the financial data administrators of Open Banking would have a policy on customer protection from accidents.

Table 4.1 Constructs and Measurement Items (cont.)

Construct	**Items used in the study**
Propensity to Trust	I am cautious when using new technologies to manage my finances. If possible, it is better to avoid using new technologies for managing my finances. I have to be careful to use Open Banking until I see evidence of it being used by others.
Performance Risk (Featherman & Pavlou 2003) 7-pt Likert and semantic differential scales	Open Banking might not perform well and create problems with my accounts. The security systems built into Open Banking are not strong enough to protect my accounts. What is the likelihood that there will be something wrong with the performance of Open Banking or that it will not work properly? (Low / high functional risk) Considering the expected level of service performance of Open Banking, it would be _____for me to sign up and use it. (Not risky at all / risky) Open Banking may not perform well and may process transactions incorrectly.
Financial Risk	What are the chances that you stand to lose money if you use Open Banking? (Low / high chance) Signing up for and using Open Banking would lead to a financial loss for me. Using Open Banking subjects my accounts to financial risk. (Improbable / probable)
Privacy Risk	What are the chances that using Open Banking will cause you to lose control over the privacy of your banking information? (Improbable / probable) Signing up for and using Open Banking would lead to a loss of privacy for me because my personal information would be used without my knowledge. (Improbable / probable)
Financial Literacy (Allgood & Walstad 2016) *correct answer	Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years how much do you think you would have in the account if you left the money to grow? (a) more than $102*; (b) exactly $102; (c) less than $102 Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in the account? (a) more than today; (b) exactly the same; (c) less than today* If interest rates rise, what will typically happen to bond prices? (a) they will rise; (b) they will fall* (c) they will remain the same; (d) there is no relationship between bond prices and the interest rate A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less. (a) true*; (b) false Buying a single company's stock usually provides a safer return than a stock mutual fund. (a) true; (b) false*

4.3 Survey Design and Sampling

4.3.1 Online survey

After adapting items for the survey, a questionnaire was designed for self-administration online. Online survey has gained major popularity in conducting research nowadays and there are significant advantages over other formats (Evans & Mathur 2005). It provides speed and timeliness in collecting data in a cost-efficient manner. The technological innovation in displaying the questions and content, as well as managing the flow of the questionnaire, also makes the survey more user-friendly. The convenience of letting the respondents complete the survey in their own time and space also adds user-friendliness and privacy. Furthermore, the data can be readily imported into analysis software which can increase the research efficiency and accuracy. Potential drawbacks such as a skewed online population and lack of experience are also discussed (Couper 2000; Evans & Mathur 2005); however, after 15 years of evolution it is believed these should be no longer of concern. As of January 2019, 87% and 90% of Australian population have access to the internet and smartphones respectively (Watt 2019), and use of the internet for all purposes has almost become a daily norm. Also, this research is concerned with the use of a financial innovation via smartphone, so an online survey will in fact give better reach to target respondents (Wright, K 2005).

4.3.2 Questionnaire design

The questionnaire is designed in a way that respondents are first asked a set of screening and demographic questions. Screening questions check if the respondent is aged 18 years or above and owns a banking account to ensure s/he represents a general banking population. Demographic questions include gender, age, region, education, income and banking account ownership, with the first three used as quota measures to ensure there is a national representation of samples.

As Open Banking is an innovation still unfamiliar to many, it is important to present clearly to the respondents how Open Banking works in reality and how it may affect their financial

management. Those who passed the screening questions are exposed to information extracted from a public website www.finder.com (Barry 2019) which describes Open Banking. The website is chosen for its comprehensive, neutral and understandable-to-layman description of Open Banking. This can also provide the advantage of simulating the exposure to information from an openly accessible source. As the website describes facts about Open Banking, in order to let the respondents visualise the application, a set of screenshots are produced to mimic a use case of Open Banking.

After presentation of information and the use case, respondents are asked two checking questions to ensure that they understand the fundamental nature and way of using Open Banking: one is to check if they grasp that Open Banking is a financial innovation that allows the exchange of banking information, and the other is if they know that Open Banking is an app downloadable from an accredited provider requiring their consent to release information. Failure to correctly answer both indicates the respondent has either not reasonably paid attention to the explanation of or misunderstood the subject. Those who correctly answered the questions would enter the main set of questions to measure the construct items. All questions require the respondents to answer before they can move to the next question.

To avoid the issue of inattentiveness in self-administered surveys (Berinsky, Margolis & Sances 2014), a screener question is inserted in the middle of questionnaire asking the respondents to simply follow an instruction of rating “strongly disagree” in the midst of other 7-point scale questions, so as to ensure the respondents maintain attention rather than habitually rating. For other challenges related to data integrity, e.g. answering too fast and giving straight line responses (Berinsky, Margolis & Sances 2014), other measures in the data cleaning stage are employed and will be discussed in the data quality assurance section. While common method bias is believed to be a potential problem for self-administered surveys (Spector & Brannick 2010), a set of questions is included to address this. The full questionnaire is attached in Appendix C.

4.3.3 Pre-test

The questionnaire was first tested among a group of 25 people, including a mix of university post-graduate students as well as government, professional and commercial sectors workers in Adelaide, Australia to ensure that the question flow is smooth and the wording is understandable. They were invited to give feedback and their survey responses were also observed for any peculiar pattern. The time they used to complete the survey was also noted to ensure the survey was designed for a reasonable duration. Most pre-test respondents found the flow smooth and the information understandable, with only a few respondents finding there was too much information to absorb. After reviewing the content, it was decided that all information should be retained for clarity, and the time and length issues (if any) would be mitigated by the attention checking question.

4.3.4 Sampling frame and data collection

This study is conducted in Australia to represent a context in which Open Banking is newly introduced. Australia is considered as well poised for leading the Open Banking development, taking the lessons learnt from the UK and progressing on infrastructure and legislation (Littlejohn 2019). It even embraces an ambition to use Open Banking as the first sector and will eventually deploy the same concept to reform other sectors like energy and telecommunications (Kehoe 2019). As a developed country, the Australian banking system and people's education in many ways are comparable to other established countries; hence the learnings from the study will not be purely local and can provide understanding of the subject in a wider perspective.

Respondents are aged between 18 and 65 years with at least one banking account, to represent the general public who have banking needs. These two criteria are embedded in the screening questions and those who do not pass are thanked and not allowed to proceed further in the survey. Region, gender and age quotas are applied to ensure there is national representation.

Qualtrics is used as the online internet panel for recruiting the respondents. Internet panel presents many advantages including cost, efficiency and reach (Hays, Liu & Kapteyn 2015). Founded in 2002, Qualtrics has established a reliable reputation in experience management including online sampling for the commercial and academic sectors (Qualtrics 2020). Qualtrics generally offers incentive in recruiting respondents ranging from AUD 3.3 - 6.5, hence the incentive is small and believed not to be significant in generating respondent bias.

The final questionnaire was administered via the Qualtrics platform in September 2019 and the whole data collection process was completed in October 2019. During the period, responses were monitored for their quota representation. Data were received in batches and in each batch data cleaning was carried out as discussed below with replenishment until the desired sample size was met.

4.4 Data Quality Assurance

4.4.1 Data cleaning

In each batch of samples received, the following criteria are used for data cleaning. Respondents who used an exceptionally short time to complete the survey were eliminated. Also, those who gave straight line responses (e.g. most answers as “neither agree nor disagree”, “agree”, “disagree” etc.), were not able to follow the screener question for attentiveness, had contradicting answers on some demographic questions (e.g. high annual income but low monthly income) were also eliminated. After each round of elimination, Qualtrics replenished new samples which underwent the same process until a satisfactory number of samples was met. Eventually 456 quality responses were collected for data analysis. Necessary recoding and reversion of scales were then carried out. As all questions are force-answered, no treatment of missing data was required.

4.4.2 Common method variance

Common method variance (CMV) refers to the systematic effect of inflating the relationships among variables by the research method, often in the case of self-administered surveys (Spector & Brannick 2010). The real impact and the best way of detection remain a debate for many researchers with some arguing the impact is exaggerated or even an urban legend (Fuller et al. 2016; Richardson, Simmering & Sturman 2009; Simmering et al. 2015; Spector 1987). Despite an inconclusive impact, a prudent approach has been taken for this study. The widely-used marker approach (Lindell & Whitney 2001) is adopted whereby an unrelated variable (marker) is chosen a priori, in this case three questions of sports attitude which are unrelated to Open Banking. The maximum correlation between the marker and other variables (as depicted in Table 4.2) is 0.26, meaning the shared variance contributed by the method is at most 0.068, which is very low. In some literature a correlation below 0.4 is accepted as no CMV effect (Lee et al. 2017). Therefore it is concluded that CMV effect does not exist. As elaborated later, this research will use PLS-SEM (partial least square structural equation modelling) for analysis. Another method advocated for PLS-SEM is to look at the VIF (variance inflation factor) among the highest order variables, and if there is no VIF greater than 3.3, it can be concluded CMV effect does not exist (Kock 2015; Kock & Lynn 2012). As Table 4.3 shows, the VIF analysis also passes this criterion, confirming no CMV effect exists.

Table 4. 2 Correlation of Marker Variable with Other Variables

	CMV marker
CMV marker	1
Usage Intention	0.214
Performance Expectancy	0.21
Effort Expectancy	0.175
Social Influence	0.256
Initial Trust	0.159
Firm Reputation	0.157
Structural Assurance	0.102
Propensity to Trust	0.037
Perceived Risk	-0.093
Financial Literacy	-0.095

Table 4. 3 VIF among Highest Order Variables

	Usage Intention
Performance Expectancy	2.436
Effort Expectancy	1.899
Social Influence	2.426
Initial Trust	2.272
Perceived Risk	1.539

4.5 Data Analysis Approach

This research uses the SEM (structural equation modelling) approach. With the increased sophistication in the research objectives, SEM has many advantages over traditional multiple regression which has the limitations of simple model structure, assuming all variables are observables and conjecturing that all variables are measured without error (Haenlein & Kaplan 2004). SEM is a multivariate statistical analysis allowing the estimation of a series of independent multiple regressions concurrently and the ability to account for measurements error in the latent variables (Nusair & Hua 2010). Indeed, SEM has been increasingly used in the past 30 years (Hair, Ringle & Sarstedt 2011). A comparative assessment using an e-commerce context study (Nusair & Hua 2010) demonstrates that SEM provides more possible path relationships for a model than multiple regression, which is valuable in research for the pursuit of knowledge, insights and stimulating further investigations. As this study has a relatively complex model that has many constructs, multiple layers of causal relationships and is measuring latent constructs like attitude and intention, SEM would be a more suitable approach.

Within the SEM stream, there are the covariance-based (CB-SEM) and variance-based approaches (PLS-SEM). CB-SEM focuses on estimating a set of model parameters with an objective to minimise the difference between the theoretical covariance matrix and the estimated covariance matrix, whereas PLS-SEM estimates model parameters to maximise the explained variance by the endogenous constructs to the exogenous construct (Hair 2017). In other words, CB-SEM seeks to make the model parameters closest to the theoretical model

but PLS-SEM seeks to adjust the model parameters to best explain the dependent variable. This primarily distinguishes the fundamental difference between them: the objective of CB-SEM is for confirming structural relationships while that of PLS-SEM is for exploring and predicting structural relationships. CB-SEM also requires certain requirements to be fulfilled, such as multivariate normality of data and minimum sample size (Hair 2017), though this requirement is not a consideration to this study which has sufficiently large sample size.

By considering the nature and objective of this study, the choice of PLS-SEM instead of CB-SEM is justified on several accounts (Haenlein & Kaplan 2004; Hair 2017; Hair, Ringle & Sarstedt 2011). Firstly, this study investigates a model comprising a relatively complex set of constructs, indicators and hypothesised relationships. It has 11 hypotheses including direct, indirect and moderating relationships. Secondly, the model is an extension and synthesis of multiple models including UTAUT, initial trust and perceived risk. It is exploring a new interacting set of relationships rather than merely confirming the existing models. The identification of these relationships is used to explain and predict the usage intention of Open Banking. Statistically, PLS-SEM has no assumption on data distribution and sample size, and it is suitable for composite models whereby the total variance is used to estimate model parameters. All these are good reasons for this study to use PlS-SEM instead of CB-SEM.

SmartPLS 3 is used as the main statistical analysis software for this research. SmartPLS 3 is a leading software for PLS-SEM analysis, and it provides functions to cater for almost all analyses involved in this study, including factor loadings, construct reliability and validity test, discriminant validity test and path modelling. Moderation and mediation analyses in a multivariate setting are also available. Running as most analyses as possible on the same platform can provide results and insights in a consistent algorithm and setting. For data cleaning, data preparation (i.e. recoding) and other analyses (i.e. descriptive statistics and group analysis), SPSS 26 and Excel are used.

4.6 Summary

In this chapter, the philosophy for choosing a quantitative approach for this study is explained. The operationalisation of constructs into scales and items are then discussed. The use of online survey and the questionnaire design to cater to the novelty of Open Banking, together with the data collection method are outlined. For data quality assurance, screening questions, data cleaning procedures and CMV detection are employed to arrive at 456 qualified respondents. Lastly, this chapter provides a logical decision path to using PLS-SEM as the most suitable analysis approach. The next chapter will discuss the analysis outcome resulting from a robust process of validating the measurement model and the structural model.

Chapter 5 Data Analysis and Findings

The previous chapter explains the adoption of a quantitative research methodology detailing items adoption, questionnaire design, data collection and data quality assurance steps. It has also enlisted the rationale for choosing PLS-SEM as the data analysis approach. This chapter focuses on the analysis results. It will first provide descriptive statistics, followed by a two-step approach of assessing the measurement model and the structural model (Haenlein & Kaplan 2004; Hair, Ringle & Sarstedt 2011). Each hypothesis in the structural model will be validated and discussed. Moderation and mediation relationships will also be explored. The final model will be presented and the model strengths will also be assessed to confirm its validity.

5.1 Descriptive Statistics

As discussed in the sampling section 4.3.4, region (8 states/territories in Australia), age and gender quotas are applied by Qualtrics in the data collection process to ensure national population is represented. The respondent profile and the associated characteristics are summarised in Table 5.1 and 5.2.

Table 5. 1 Respondents' Profile and Characteristics

	%	Kurtosis	Skewness
Age		-1.19	0.02
18-24	15.4		
25-34	24.3		
35-44	21.1		
45-54	21.7		
55-64	17.5		
Gender		N/A	N/A
Female	51.8		
Male	47.8		
Others	0.4		
Education		-0.86	0.13
High school	22.4		
Some college	35.7		
Degree / asso degree	32.5		
Post-graduation	9.4		
Annual Income (AUD) (Before tax)		-0.73	-0.04
< $18,200	19.3		
$18,201-37,000	22.1		
$37,001-90,000	39.7		
$90,001-180,000	16.4		
>$180,001	2.4		
No. of financial institution relationships		-0.31	-0.40
1	43.4		
2	31.8		
3	17.1		
4	5.3		
5	1.3		
Total no. of accounts currently own		-1.32	-0.07
6 or below	18.2		
7	18.2		
8	22.4		
9	15.4		
10 or above	25.9		

Table 5. 2 Respondents' Financial Literacy and Usage Intention

	Mean	Median	Mode	Kurtosis	Skewness
Financial Literacy	3.52	4	4	-0.31	-0.40
Usage Intention	4.29	4.33	4	-0.02	-0.59

Sample demographics. Out of the 456 samples, 61.7% are between 25-54 years old, with the mode falling into the younger group of 25-34. 51.8% are female. In terms of education, the biggest group is some college education (36%) while close to 42% have attained a degree or above. Close to 40% are in the middle income range with annual income before tax between $37,001 -$90,000.

Financial background. The survey also measures their current financial institution relationships. 43.4% bank with only one financial institution and 23.7% bank with three or more. The survey also asks their number of accounts currently owned by categories (savings and checking accounts, credit card, mortgage, personal loan/overdraft, and investment account), with the total number of accounts indicating their diversification in banking needs. The lowest group 6 or below contribute 18.2% but close to 26% own 10 accounts or above. As the design of Open Banking facilitates offers comparison and switching of account relationships, it will be interesting to see if the multiplicity of financial and account relationships will play a role in affecting usage intention as well. In addition, Table 5.2 shows their financial literacy. The respondents have above middle financial literacy, scoring 3.5 out of 5 with the mode at 4.

Average rating of usage intention. As a preliminary overview, their average rating of usage intention of Open Banking is also calculated. As confirmatory factor loading has not come into analysis at this stage, the average rating is calculated based on equal weight among 3 indicators of the construct. As shown in Table 5.2, the mean and mode centre around 4, indicating most respondents are indifferent ("neither agree nor disagree") on the usage intention of Open Banking. This probably is attributed by the unfamiliarity of Open Banking, making understanding the drivers behind the usage intention all the more important and insightful.

Sample distribution. Since the demographic answers are given on nominal scale rather than numeric scale, to assess the sample distribution, skewness and kurtosis instead of range and standard deviation are reviewed. Skewness assesses the extent to which a variable's distribution is symmetrical, whereas kurtosis is a measure of whether the distribution is too narrow with most of the responses in the centre. A general guideline for both indicators is, if they are within -1 to +1, the data distribution is considered normal with no skewness and

kurtosis issues (Hair 2017). The variables described above in general display normal distribution, except that age and total number of accounts have kurtosis of less than -1, indicating a flatter-than-normal distribution. Since age is a quota representing national samples and total number of accounts is merely a reflection of the respondents' financial situation, the sample distribution quality is considered satisfactory.

5.2 Assessment Approach of PLS-SEM

The algorithm of PLS-SEM follows a two-step approach that involves separate assessment of the measurement model and the structural model (Haenlein & Kaplan 2004; Hair 2017; Hair, Ringle & Sarstedt 2011). The measurement model, commonly called the outer model, is the estimation of the weight relations that link the indicators to their respective latent construct. The structural model, commonly referred to as the inner model, calculates the case values based on the indicator weight and these case values are calculated in a set of regression equations to determine the parameters for the structural relations in the model (Haenlein & Kaplan 2004). This study will follow this two-step approach by applying a set of established guidelines from previous literature (Benitez et al. 2020; Hair 2017; Henseler, Hubona & Ray 2016) in each step.

5.3 Measurement Model

It is important to distinguish between reflective and formative measurement models to carry out the appropriate evaluations (Hair, Ringle & Sarstedt 2011). Fundamentally, it is because the former uses a set of indicators to reflect a latent construct and therefore a change in the construct should cause a change to all indicators, whereas the latter is the opposite in the sense that a change in a formative indicator should cause a partial change depending on its weight to the construct. Statistically a reflective measurement looks for maximising the overlap between the indicators, while a formative measurement is trying to minimise the overlap between the indicators, hence leading to different perspectives of evaluation (Hair 2017).

All the main constructs in this model, e.g. usage intention, perceived risk, initial trust, are unobservable constructs (latent constructs) and a set of indicators are used to measure them. For example, there are 3 indicators for usage intention expectedly measuring the underlying

construct, and if usage intention changes, so should those 3 indicators. As such the measurement model is a reflective model. For reflective model, a confirmatory factor analysis (CFA) should be conducted to assess its reliability and validity (Netemeyer 2003; Nusair & Hua 2010).

5.3.1 Measurement model reliability

Two aspects, item reliability and construct reliability, are assessed (Fornell & Larcker 1981; Hair 2018). Item reliability indicates the amount of variance in an item explainable by the underlying construct, and is assessed by factor loadings which should be >0.7 (Benitez et al. 2020; Hair, Ringle & Sarstedt 2011; Nusair & Hua 2010). Construct reliability measures the internal consistency of a construct; and Hair et al. opines that for PLS-SEM, composite reliability is more suitable than Cronbach's alpha, with value >0.7 being regarded as satisfactory (Hair, Ringle & Sarstedt 2011). Table 5.3 shows the reliability assessment of the measurement model after running the confirmatory factor analysis.

From the confirmatory factor analysis all items have good factor loadings with the majority above 0.8, except 2 items (SI3 and PR7) in the 0.6 range and 1 item (PT1) in the 0.5 range. Nevertheless the p-value of all items are 0.000. With regards to the composite reliability, all constructs show satisfactory results too with all measures well above 0.7. In case an item has loading between 0.4 - 0.7, it should only be considered to be removed from the scale if the removal leads to an increase in composite reliability (Hair, Ringle & Sarstedt 2011). To determine if SI3, PR7 and PT1 should be deleted, the composite reliability is refreshed for comparison after the items are deleted. It is found that deletions of SI3 and PT1 lead to an increase while that of PR7 causes a decrease in composite reliability. Consequently, SI3 ("I expect that Open Banking would be trendy") and PT1 ("I am cautious when using new technologies to manage my finances.") are deleted from the scale.

Table 5. 3 Measurement Model Reliability Assessments Results

	Factor Loadings	p-value	Composite Reliability		Item Decision	Final Loadings
			Original	*Remove <0.7 items*		
Usage Intention			0.975			
UI1	0.959	0.000				0.959
UI2	0.962	0.000				0.962
UI3	0.969	0.000				0.968
Performance Expectancy			0.95			
PE1	0.912	0.000				0.911
PE2	0.924	0.000				0.924
PE3	0.933	0.000				0.933
PE4	0.864	0.000				0.866
Effort Expectancy			0.951			
EE1	0.858	0.000				0.858
EE2	0.933	0.000				0.933
EE3	0.935	0.000				0.935
EE4	0.912	0.000				0.912
Social Influence			0.882	0.898		
SI1	0.854	0.000				0.873
SI2	0.861	0.000				0.87
SI3	0.658	0.000			Remove	
SI4	0.843	0.000				0.847
Initial Trust			0.962			
IT1	0.945	0.000				0.946
IT2	0.954	0.000				0.954
IT3	0.937	0.000				0.936
Firm Reputation			0.886			
FR1	0.914	0.000				0.914
FR2	0.87	0.000				0.87
FR3	0.92	0.000				0.92
Structural Assurance			0.886			
SA1	0.788	0.000				0.788
SA2	0.798	0.000				0.798
SA3	0.838	0.000				0.838
SA4	0.827	0.000				0.827
Propensity to Trust			0.807	0.839		
PT1	0.578	0.000			Remove	
PT2	0.913	0.000				0.925
PT3	0.776	0.000				0.771
Perceived Risk			0.943	0.937		
PR1	0.762	0.000				0.762
PR2	0.809	0.000				0.81
PR3	0.809	0.000				0.809
PR4	0.812	0.000				0.813
PR5	0.789	0.000				0.788
PR6	0.783	0.000				0.782
PR7	0.682	0.000			Retain	0.68
PR8	0.829	0.000				0.829
PR9	0.812	0.000				0.813
PR10	0.803	0.000				0.804

5.3.2 Measurement model validity

In addition, the measurement model is assessed for its validity. In the case of reflective models, convergent validity and discriminant validity are reviewed (Benitez et al. 2020; Hair, Ringle & Sarstedt 2011). Convergent validity assesses the degree of dimensional correlation of the scale, and high correlations means the scale measures its intended construct (Nusair & Hua 2010). An AVE (average variance extracted) value of higher than 0.5 indicates a sufficient convergent validity, meaning the latent variable is able to explain more than half of the indicators' variance (Benitez et al. 2020; Fornell & Larcker 1981; Hair, Ringle & Sarstedt 2011). As shown in Table 5.4, the AVE of all constructs (the values on the diagonal) are well above 0.5, proving the convergent validity of the scale.

Table 5. 4 Fornell Larcker Criterion

(Diagonal AVE > construct squared correlation with others for satisfactory convergent validity)

	Effort Expectancy	Firm Reputation	Structural Assurance	Initial Trust	Perceived Risk	Performance Expectancy	Propensity to Trust	Social Influence	Usage Intention
Effort Expectancy	0.91								
Firm Reputation	0.623	0.902							
Structural Assurance	0.433	0.52	0.813						
Initial Trust	0.622	0.791	0.497	0.946					
Perceived Risk	-0.476	-0.5	-0.289	-0.549	0.79				
Performance Expectancy	0.564	0.586	0.382	0.607	-0.467	0.909			
Propensity to Trust	0.392	0.269	0.189	0.306	-0.527	0.355	0.851		
Social Influence	0.528	0.62	0.324	0.613	-0.458	0.721	0.296	0.864	
Usage Intention	0.548	0.532	0.372	0.57	-0.466	0.817	0.403	0.67	0.963

On the other hand, discriminant validity requires that constructs are distinctive in measuring different concepts and should have low correlations with each other (Nusair & Hua 2010). The Fornell-Larcker criterion is perhaps the most widely used approach which posits that a latent variable should share more variance with its indicators than with other latent variables, and therefore the AVE of the construct should be higher than its squared correlation with other constructs (Fornell & Larcker 1981). Table 5.4 also shows the result of this criterion test. Another common assessment is to observe the cross loadings (Table 5.5), whereby an indicator should have higher loading with its construct than with other constructs (Hair, Ringle & Sarstedt 2011; Henseler, Hubona & Ray 2016).

Table 5. 5 Cross Loadings of Items

(Item should have highest loadings with the construct than with others for satisfactory discriminant validity)

	Effort Expectancy	Firm Reputation	Structural Assurance	Initial Trust	Perceived Risk	Performance Expectancy	Propensity to Trust	Social Influence	Usage Intention
EE1	0.858	0.652	0.434	0.634	-0.442	0.51	0.311	0.538	0.491
EE2	0.933	0.565	0.419	0.576	-0.446	0.536	0.371	0.482	0.524
EE3	0.935	0.539	0.364	0.537	-0.422	0.5	0.352	0.448	0.483
EE4	0.912	0.506	0.355	0.513	-0.419	0.503	0.392	0.452	0.493
FR1	0.55	0.914	0.478	0.744	-0.477	0.506	0.224	0.538	0.453
FR2	0.546	0.87	0.442	0.641	-0.379	0.517	0.27	0.538	0.479
FR3	0.588	0.92	0.483	0.747	-0.488	0.563	0.237	0.6	0.508
SA1	0.365	0.481	0.788	0.441	-0.274	0.353	0.152	0.307	0.334
SA2	0.386	0.391	0.798	0.351	-0.209	0.274	0.207	0.209	0.257
SA3	0.316	0.399	0.838	0.401	-0.245	0.318	0.163	0.255	0.316
SA4	0.344	0.41	0.827	0.411	-0.206	0.288	0.1	0.269	0.292
IT1	0.59	0.746	0.465	0.946	-0.504	0.568	0.299	0.572	0.518
IT2	0.553	0.737	0.493	0.955	-0.519	0.582	0.262	0.576	0.538
IT3	0.621	0.76	0.452	0.936	-0.534	0.57	0.307	0.591	0.56
PR1	-0.424	-0.386	-0.239	-0.47	0.762	-0.4	-0.469	-0.412	-0.399
PR2	-0.388	-0.37	-0.163	-0.465	0.81	-0.391	-0.456	-0.402	-0.43
PR3	-0.41	-0.441	-0.271	-0.451	0.809	-0.413	-0.38	-0.374	-0.39
PR4	-0.412	-0.469	-0.278	-0.475	0.813	-0.396	-0.417	-0.395	-0.406
PR5	-0.365	-0.333	-0.2	-0.385	0.788	-0.378	-0.429	-0.343	-0.361
PR6	-0.308	-0.34	-0.227	-0.389	0.782	-0.318	-0.413	-0.279	-0.301
PR7	-0.313	-0.361	-0.329	-0.361	0.68	-0.359	-0.365	-0.273	-0.319
PR8	-0.414	-0.389	-0.179	-0.423	0.829	-0.362	-0.481	-0.383	-0.387
PR9	-0.347	-0.433	-0.182	-0.443	0.813	-0.338	-0.356	-0.373	-0.336
PR10	-0.347	-0.413	-0.231	-0.448	0.804	-0.315	-0.377	-0.345	-0.324
PE1	0.535	0.52	0.328	0.549	-0.455	0.911	0.386	0.689	0.832
PE2	0.488	0.5	0.349	0.53	-0.41	0.924	0.315	0.63	0.717
PE3	0.509	0.524	0.338	0.544	-0.412	0.933	0.306	0.659	0.736
PE4	0.515	0.588	0.375	0.581	-0.417	0.866	0.276	0.64	0.675
PT1	0.415	0.287	0.258	0.313	-0.432	0.385	0.925	0.319	0.426
PT2	0.213	0.141	0.006	0.187	-0.499	0.178	0.771	0.153	0.22
SI1	0.507	0.572	0.327	0.543	-0.396	0.621	0.264	0.873	0.567
SI2	0.397	0.476	0.256	0.475	-0.373	0.583	0.254	0.87	0.579
SI4	0.462	0.555	0.255	0.566	-0.415	0.661	0.248	0.847	0.588
UI1	0.556	0.508	0.358	0.559	-0.453	0.78	0.4	0.628	0.959
UI2	0.511	0.504	0.361	0.535	-0.456	0.796	0.385	0.648	0.962
UI3	0.517	0.526	0.355	0.552	-0.438	0.785	0.379	0.66	0.968

While these two methods represent the dominant approaches, as the study of PLS-SEM methodology enriches, there is some recent literature advocating HTMT (heterotrait-monotrait) ratio of correlations as a better method (Ab Hamid, Sami & Mohmad Sidek 2017; Benitez et al. 2020; Henseler, Hubona & Ray 2016; Henseler, Ringle & Sarstedt 2015). In a Monte Carlo simulation study (Henseler, Ringle & Sarstedt 2015), Henseler et al. argues that HTMT is able to identify discriminant issue which the two traditional approaches cannot. Less than 0.9 is considered satisfactory while less than 0.85 can be used as a stringent criterion. Table 5.6 shows the result of HMMT criterion test. With all three approaches used to assess the validity of the measurement model in this study (Table 5.4, 5.5, 5.6), the

measurement model is shown to pass all assessments and demonstrate its discriminant validity.

Table 5. 6 HTMT Criterion

(< 0.9 for satisfactory discriminant validity)

	Effort Expectancy	Firm Reputation	Structural Assurance	Initial Trust	Perceived Risk	Performance Expectancy	Propensity to Trust	Social Influence
Effort Expectancy								
Firm Reputation	0.686							
Structural Assurance	0.493	0.602						
Initial Trust	0.664	0.864	0.559					
Perceived Risk	0.507	0.545	0.329	0.583				
Performance Expectancy	0.605	0.647	0.432	0.649	0.499			
Propensity to Trust	0.475	0.335	0.229	0.375	0.701	0.424		
Social Influence	0.6	0.722	0.386	0.692	0.515	0.819	0.378	
Usage Intention	0.579	0.577	0.413	0.599	0.489	0.862	0.481	0.75

5.4 Structural Model

After the measurement model is thoroughly assessed, the items are loaded accordingly. The structural model is evaluated by running PLS algorithm and bootstrapping analyses on SmartPLS. Each hypothesis is validated with findings discussed below.

5.4.1 Impact of performance expectancy on usage intention

In literature review, performance expectancy (or perceived usefulness in equivalence) consistently comes as the most significant factor to usage intention (Farah, Hasni & Abbas 2018; Luo et al. 2010; Oliveira et al. 2014; Wessels & Drennan 2010; Zhou, Lu & Wang 2010). In this study, it is no exception. The path coefficient for H1 is 0.649 ($p<0.001$), therefore the hypothesis is supported. Indeed, performance expectancy is the predominant driver of usage intention of Open Banking. Table 5.7 shows the direct effects and total effects of different constructs to usage intention. Performance expectancy has only one path influencing usage intention but that by itself represents the most influential one (0.649). It demonstrates that, when it comes to adopting Open Banking, consumers put the rational consideration of what benefits they can receive as the highest priority.

Table 5. 7 Total Effect and Direct Effect on Different Constructs to Usage Intention

	Direct Effect	Total Effect
Performance Expectancy	0.649	0.649
Social Influence	0.13	0.465
Initial Trust		0.273
Effort Expectancy	0.082	0.213
Firm Reputation		0.189
Structural Assurance		0.035
Propensity to Trust		0.03
Financial Literacy		-0.027
Perceived Risk	-0.063	-0.063

5.4.2 Effect of effort expectancy on usage intention, perceived risk, and performance expectancy

Effort expectancy is hypothesised to positively influence usage intention of Open Banking. The path coefficient for H2 is 0.082 ($p < 0.05$), suggesting this hypothesis is supported. As discussed in the literature review, effort expectancy (or perceived ease of use in equivalence) is not always a significant direct antecedent to usage intention. This study result is consistent with the original UTAUT model and some literature that if the innovation is perceived easy to use, the intention to use will be higher (Farah, Hasni & Abbas 2018; Lin 2011; Shaikh, Glavee-Geo & Karjaluoto 2018; Wessels & Drennan 2010).

Moreover, the path coefficients of effort expectancy on perceived risk (H9) and performance expectancy (H10) are -0.219 ($p<0.001$) and 0.18 ($p<0.01$) respectively; suggesting both hypotheses are supported. In other words, effort expectancy also acts through perceived risk and performance expectancy to affect usage intention. The significance of the mediating relationship can be assessed by utilizing the specific indirect relationship function in SmartPLS 3. The significance of these mediating effects is: 0.08 (EE -> PR -> UI) and 0.001 (EE -> PE -> UI). Some studies also find effort expectancy positively affects performance expectancy (Alalwan, Dwivedi & Rana 2017; Shaikh, Glavee-Geo & Karjaluoto 2018; Zhou, Lu & Wang 2010). The easier to use, the more useful the technology will be perceived. However, rare literature hypothesised and validated effort expectancy to offset perceived risk

and the result of this study provides a new direction of thought. It is logical because perceived risk is a result of uncertainty. If the technology or innovation is easy to use, it will remove some of the uncertainties that the user is facing.

The above relationships and their significance bring an interesting point for discussion. While the direct effect of effort expectancy is only 0.082 (Table 5.7), its total effect is 0.213 on usage intention. It was expected that given Open Banking is an unfamiliar and novel technology, ease of use will be a key consideration for adoption. The more remarkable total effect than direct effect implies that the implications of effort expectancy should be considered in totality on multiple facets. Nowadays there are over 5 million apps on the Apple App store and Google Play store and an average smartphone owner uses 30 apps per month relating to all aspects of daily life (Blair 2019). It is expected that apps will be simple to use and the interaction be user-oriented (Hamilton 2019). When ease of use is an expectation taken for granted or assumed, effort expectancy may become low or significant (Baptista, Gonçalo & Oliveira 2015). Consumers may not or do not need to deliberately think they will use Open Banking because it is easy to use. It may be the reason that effort expectancy does not come as a direct construct as important as expected. However, despite the relatively low direct impact, effort expectancy still plays a key role in affecting usage intention. Its influence is through increasing performance expectancy and lowering perceived risk. In other words, making it easy to use will also make it perceived as more useful and less risky.

5.4.3 Influence of social influence on usage intention

The path coefficient of social influence on usage intention is 0.13 ($p < 0.01$), showing H3 is also supported. In fact, social influence is the second most influential direct determinant to usage intention (Table 5.7). Social influence works on an observability basis and peer influence has proven to be effective for some financial decisions (e.g. charitable giving programs) but not others (e.g. retirement savings and insurance purchase) (Lieber & Skimmyhorn 2018). The nature of Open Banking being a tool for decision on banking products and institutions would suggest it is a private or unobservable one. Indeed, in the comparable context of mobile banking studies, social influence is not a consistent factor (Baptista, Gonçalo & Oliveira 2016), with some supporting it (Yu 2012; Zhou, Lu & Wang

2010) but more rejecting it (Alalwan, Dwivedi & Rana 2017; Baptista, Gonçalo & Oliveira 2015; Oliveira et al. 2014; Sarfaraz 2017). In particular, it is expected that social influence is more important in less developed societies of high power distance where people take in account of influential people's references (Baptista, Gonçalo & Oliveira 2015). The significance of social influence reflected in this study of Australia which is a society with much less power distance reflects that social influence does play an important role for very novel applications like Open Banking.

Another finding worth even more attention is that social influence is found to have a strong effect on performance expectancy (0.518, $p<0.001$), in turn creating a strong mediating relationship to usage intention. Its effect on performance expectancy is in fact much heavier than its direct influence on usage intention which is 0.13. When the indirect effect of mediating through performance expectancy is taken into account, its total effect becomes 0.465 (Table 4.5.1), making it the second most important driver to usage intention. This poses a need to rethink the traditional beliefs about the role of social influence.

The traditional UTAUT model solely posits social influence as a direct determinant to usage intention. In other words, people develop an intention to adopt a new thing because they see others using it. Most subsequent literature also investigates this notion of a direct relationship. The finding of this study suggests that the impact of social influence in past studies might have been underestimated, as they only investigate the direct effect rather than the total effect. While some previous studies attribute the insignificance of social influence to financial technology adoption being a rational or personal decision (Oliveira et al. 2014) or the effect of social parity (Baptista, Gonçalo & Oliveira 2015), the true effect could only be seen when its mediation effect is taken into consideration. Of the literature reviewed, there is only one study that has hypothesised and validated the effect of social influence on performance expectancy (Kesharwani & Singh Bisht 2012). It investigates internet banking adoption and hypothesises an internalisation process, which is "an informational (as opposed to normative) social influence, and is defined as the influence to accept information from another as evidence about reality". Their result supports the notion that social influence does have effect on perceived usefulness (0.128), though the effect is not as strong as its direct effect on usage intention (0.169). The much heavier weight of social influence on performance expectancy resulting from this study confirms and even more strongly supports the internalisation effect. This goes beyond the traditional UTAUT thought and gives an

additional, enriched perspective to the role of social influence. The behaviour should not be dealt with using a pure outcome perspective that someone adopts an innovation because others are using it. Instead, it should be a reasoning (informational) perspective that s/he gets to know the benefits of the innovation through others, therefore s/he will use it.

5.4.4 Effect of perceived risk on usage intention

Perceived risk is hypothesised to negatively affect the usage intention of Open Banking (H4). The path analysis shows the path coefficient being -0.063 and p-value < 0.05. Hence H4 is also supported. It is not a surprising finding that perceived risk will reduce the usage intention of Open Banking and it is consistent with most of the previous studies (Chen 2013; Luo et al. 2010).

The complexity and uncertainty of technology coupled with the sensitive nature of finance and personal data poses uncertainty and perceived risk to consumers (Chellappa & Sin 2005; Cunningham, Gerlach & Harper 2005; Pavlou 2003). This makes FinTech inherent with perceived risk that may affect adoption, and the results of this study confirms some of the previous studies (Luo et al. 2010; Martins, Oliveira & Popovič 2014; Mha 2015). Open Banking in particular performs functions that critically rely on the exchange of personal financial data, therefore data security and privacy concern are highly anticipated by the industry as a potential deterrent to adoption (Dynes 2018; Eyers 2018e). The significant but relatively mild impact of perceived risk on the adoption intention found in this study is somewhat out of expectation. While the younger age group usually tends to perceive less risk in technologies (Akturan & Tezcan 2012), this reason does not hold true for this research, which has an age distribution representative of the Australian population. Regardless of the risk facets debate, perceived risk is agreed to have two components: uncertainty and consequences (Mitchell 1999), which boils down to how likely one thinks the adversity may happen and the negative consequences when it does happen. These can be influenced by factors like culture and market contexts which have gained empirical evidence (Park & Jun 2003; Zhao et al. 2008). For example, in a market where technology is common and has rare risk incidents, people may feel more remote to the likelihood and consequence of a potential incident. The results in this research shows the adoption decision of Open Banking by Australians is only modestly influenced by their perceived risk of it. Interestingly, the magnitude of influence by perceived risk is similar to another mobile banking study in an

Australian context (Wessels & Drennan 2010). The author of this research suggests the low impact of perceived risk should not be taken as the same across different markets, but rather, a potential avenue for future research to look into the possible differences exhibited by the markets.

Another positive point about perceived risk is that it can be further alleviated by improved effort expectancy and initial trust. The former relationship has been discussed in 5.4.2 and its relationship with initial trust will be discussed below.

5.4.5 Effect of initial trust on usage intention, perceived risk, performance expectancy and effort expectancy

For initial trust, it is hypothesised to positively influence usage intention of Open Banking (H5). The p for this path coefficient is >0.05, indicating the direct relationship of initial trust on usage intention is not significant and H5 is not supported. Contrastingly, it has a strong path coefficient -0.413 ($p<0.001$) to perceived risk, which supports H6 and illustrates that initial trust actually operates through perceived risk as a mediator. Using the same specific indirect relationship function in SmartPLS 3, the mediating significance from IT->PR->UI is 0.039, confirming the mediation effect. Initial trust as a positive influencer to performance expectancy (H7) and effort expectancy (H8) are also supported, with path coefficients being 0.177 ($p<0.01$) and 0.624 ($p<0.001$). The positive effect of initial trust on performance expectancy and effort expectancy supports the findings of a previous mobile payment research study (Gao & Waechter 2017). The mediating effects of initial trust via both constructs to usage intention are also confirmed with significance at 0.001 (IT->PE->UI) and 0.002 (IT->EE->UI).

To investigate the dynamics further, initial trust model is run on a standalone basis to see its impact on usage intention. It is found that the adjusted R^2 of usage intention is 0.642, meaning initial trust as a standalone model explains usage intention well. But when it is integrated with other constructs into the model, its direct influence drops to an insignificant level. The significant mediation but not direct relationship shows that initial trust acts through perceived risk to influence usage intention by remarkably offsetting perceived risk. This supports the earlier seminal work (Mitchell 1999; Pavlou 2003) on the directionality and causality between trust and risk in an e-commerce context – risk must exist at the beginning

for trust to take effect, and trust acts on and reduces risk rather than the other way round. Another mobile banking adoption study which has posited both risk and trust as direct antecedents to usage intention also finds that while risk is a significant determinant but trust is not (Sarfaraz 2017). While in that case trust may be concluded to be not significant in an adoption decision, the finding of this study provides a strong case that the conclusion may not be true, as trust has to mediate through perceived risk.

Another interesting finding is that, with initial trust having material impact on two other UTAUT constructs, performance expectancy and effort expectancy, its total effect to usage intention is 0.273 (Table 5.7), making it the third most influential construct even more influential than effort expectancy. The way to interpret this it is that when people have initial trust, they believe Open Banking is useful (increase performance expectancy). When they have initial trust, it also largely helps them believe Open Banking is easy to use (increase effort expectancy).

Given the importance of initial trust, it will be helpful to understand what the drivers are. The three lower level constructs, firm reputation, structural assurance and propensity to trust are all found significant to affect initial trust. This echoes the original intended model of Kim et al. (Kim, G, Shin & Lee 2009). Out of the three, firm reputation has a dominant effect of 0.619 to initial trust. Surprisingly, structural assurance does not play a role as important as expected (0.13), nor as the original model. The original model is in the mobile banking context where providers are well known to consumers, so structural assurance is believed to have outweighed firm reputation on the impact to initial trust. In the Open Banking context where providers are unknown to consumers, the results show that who is providing the service is more important than what the compensation will be in times of trouble. In other words, consumers have confidence that if the one providing the service has a good reputation, the assurance of good conduct will come with that.

5.4.6 Influence of financial literacy on performance expectancy and effort expectancy

In the conceptual model, financial literacy is hypothesised to moderate the relationships of performance expectancy and effort expectancy to usage intention (H11a and H11b respectively). However, the result of the analysis shows that the moderating effect of

financial literacy yields a p-value of 0.57 for performance expectancy and 0.11 for effort expectancy, hence both moderating hypotheses are rejected.

In a study of investigating the influence of financial literacy to usage intention of personal financial blogs (Hoffmann & Otteby 2018), it is found that financial literacy affects perceived helpfulness of personal financial blogs, which indicates that financial literacy plays a role in forming one's perception towards external information. To explore the influence of financial literacy in the model, its relationship with initial trust is further investigated. It is found that the path coefficient of financial literacy to initial trust is -0.099 with p-value < 0.001. In other words, financial literacy is a direct, negative antecedent to initial trust.

Mainstream knowledge-based trust theories posit that knowledge towards a trustor over time can reduce uncertainty and increase trust (Mayer, Davis & Schoorman 1995). Knowledge in the form of familiarity and expertise with the subject constitutes part of the user predisposition towards innovation adoption (Rao & Troshani 2007). However, this theory is not applicable in this case as financial literacy is not related to the direct knowledge about Open Banking, but rather the knowledge of the domain, i.e. the context that Open Banking is operating in. Moreover, as initial trust theory suggests, people rely on clues rather than knowledge to form trust for innovations where they have no prior experience to rely on. The finding from this study is consistent with a report which finds skilled internet users in fact have less trust upon the internet for information exchange (Hoffman, Novak & Peralta 1999). In descriptive terms, it can be interpreted that the more financial knowledge one has, the more sceptical s/he is and the lower the initial trust towards Open Banking. To confirm if the magnitude of this effect is substantial, effect size f^2 is reviewed, and an $f^2 > 0.02$ indicates the effect is of practical relevance (Benitez et al. 2020; Henseler, Hubona & Ray 2016). The f^2 of this path relationship is 0.027, hence the negative effect of financial literacy to initial trust can be confirmed.

5.4.7 Other moderating effects

In the original UTAUT model, age and gender are moderators to performance expectancy, effort expectancy and social influence on usage intention. Although they are not hypothesised in this study, their moderating relationships are also tested but found to be not significant.

This study also gathered other demographic information including education and annual income. It is found that while education is a moderator to the relationship of performance expectancy on usage intention, annual income is not (Table 5.8). This contrasts to the industry belief that Open Banking appeals to the higher income group (Swinton & Roma 2018a). This means that from a demographic perspective education, rather than age, gender and income, will strengthen the influence of performance expectancy on usage intention. Moreover, the financial situation of the respondents including the number of financial institutions they have relationship with and the number of accounts they own – as an indication of their diversification of banking needs – are also measured. It is found that number of financial institutions is a moderator to the relationship of performance expectancy on usage intention for Open Banking (Table 5.8). In other words, the more financial institution relationships, the more the influence of performance expectancy on usage intention of Open Banking. This means that for people with more diversified banking needs, they will be more prone to use Open Banking than others given the same level of performance expectancy. This echoes the original design intention of Open Banking, which is to facilitate the comparison and switching of financial institution products and offers.

Table 5. 8 Other Moderating Relationships

Moderator	To relationship	Moderating effect	p-value
Education	Performance Expectancy -> Usage Intention	0.043	0.049
Number of financial institutions	Performance Expectancy -> Usage Intention	0.048	0.035

5.5 Model Evaluation

Age, gender, education and income are further introduced into the model as controlled variables. To summarise, the conclusion of the hypotheses as well as the additional findings are listed in Table 5.9 and 5.10 respectively, and the final model is depicted in Fig. 5.1.

Table 5. 9 Results of Hypothesis Testing

Hypothesis	**Conclusion**	**Path coefficient**
H1 Performance expectancy positively influences usage intention	Supported	0.649***
H2 Effort expectancy positively influences usage intention	Supported	0.082*
H3 Social influence positively influences usage intention	Supported	0.13**
H4 Perceived risk negatively influences usage intention	Supported	-0.063*
H5 Initial trust positively influences usage intention	Not supported	
H6 Initial trust negatively influences perceived risk	Supported	-0.413***
H7 Initial trust positively influences performance expectancy	Supported	0.177**
H8 Initial trust positively influences effort expectancy	Supported	0.624***
H9 Effort expectancy negatively influences perceived risk	Supported	-0.219***
H10 Effort expectancy positively influences performance expectancy	Supported	0.18**
H11a Financial literacy is a moderator to the relationship of H1	Not supported	
H11b Financial literacy is a moderator to the relationship of H2	Not supported	

**p-value < 0.05, **p-value < 0.01, ***p-value < 0.001, two-tailed test*

Table 5. 10 Additional Findings

Additional Findings	**Path coefficient**
Financial literacy is a direct antecedent to initial trust	-0.099***
Social influence is a direct antecedent to performance expectancy	0.518***
Education Number of financial institutions are moderators to performance expectancy on usage intention	0.043* 0.048*

**p-value < 0.05, **p-value < 0.01, ***p-value < 0.001, two-tailed test*

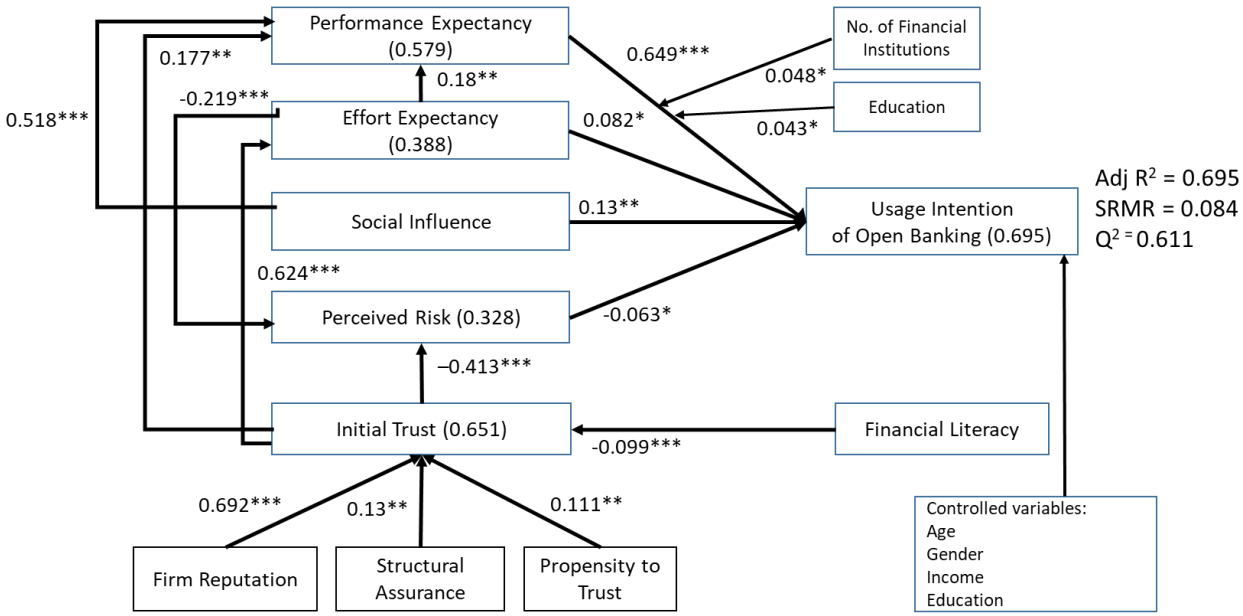


Figure 5. 1 The Final Model

Apart from the significance of path coefficients, a structural model should be assessed for its overall fit, coefficient of determination R^2 and predictive power Q^2 (Hair, Ringle & Sarstedt 2011; Henseler, Hubona & Ray 2016). Model fit refers to how well the data fits to the specified model structure rather than their natural correlations, and different GOF (goodness-of-fit) indices have been discussed along the evolvement of PLS-SEM, with SRMR (standardized root mean square) favoured as the most appropriate index to identify model misspecification in a covariance structure modelling setting (Benitez et al. 2020; Henseler, Hubona & Ray 2016; Hu & Bentler 1998). SRMR helps to answer the question of how substantial the discrepancy between the model implied and the empirical correlation matrix is, with a lower value indicating a better model fit (Henseler, Hubona & Ray 2016). A cut-off value close to 0.08 is considered adequate for PLS models (Hu & Bentler 1998). The SRMR for the final model in this study is 0.084, indicating that the model fit is adequate.

The adjusted R^2 of the dependent variable usage intention is 0.695, indicating that 69.5% of the variance of usage intention can be explained by the model. Although the adequacy of R^2 can be liberal and depends on disciplines, 0.69 is considered a strong value (Benitez et al. 2020; Hair, Ringle & Sarstedt 2011), and indeed remarkably better than those appearing in the technology adoption literature previously reviewed, of which R^2 usually lies in the 0.3-0.5 range.

Lastly, as the choice of PLS-SEM stems from the justification that PLS-SEM suits causal models with a prediction-oriented objective, the predictive power of the model Q^2 is reviewed. It is done by blindfolding on SmartPLS 3 to obtain cross-validated redundancy measures for the constructs, where $Q^2 > 0.35$ presents a strong prediction relevance (Hair 2017). The dependent variable usage intention in the model yields a Q^2 of 0.611, hence the predictive power is affirmed.

5.6 Summary

In this chapter the measurement model and the structural model are thoroughly assessed. Most of the hypotheses are established with significance and notably some interesting new relationships are also identified. The final model has good model fit, variance explanation and predictive power. It shows that the UTAUT variables – performance expectancy, effort expectancy and social influence – are influencers to usage intention, with performance expectancy being the predominant factor. Social influence has in fact a much stronger effect on performance expectancy than its direct impact on usage intention. While perceived risk is also an influencer to usage intention, it has a relatively light impact. Furthermore, initial trust and effort expectancy are negative factors to it, meaning that they can mitigate perceived risk. For initial trust, it does not directly affect usage intention but has a strong total effect by positively driving performance expectancy and effort expectancy. Lastly, instead of being a moderator as hypothesised, financial literacy has a direct negative effect on initial trust. The implications of these findings will be further discussed in the upcoming chapter.

Chapter 6 Discussion and Conclusion

The previous chapter has assessed the measurement model and the structural model in detail. The 11 hypotheses in the conceptual model have been validated, with 9 hypotheses for UTAUT, perceived risk and initial trust in relation to usage intention supported and discussed in depth. Initial trust as a direct antecedent to usage intention and financial literacy as a moderator to performance expectancy and effort expectancy on usage intention are not supported. However there are some new and interesting effects identified for initial trust, financial literacy and social influence. The final model is established with adequate model fit,

good explanatory power and predictive power. In this chapter, the research question will be revisited to ensure that the findings can meet the research objective. It will further discuss the implications and contributions to both the theoretical and practical sides. Lastly, research limitations and future research directions will be proposed before this final chapter concludes the thesis.

6.1 Findings Summary

Open Banking is a new innovative concept using technology to allow customers to take control of their financial data and make better financial choices. Driven by different governments, it is expected to enhance consumer fairness and bring banking competition to a level playing field. Motivated by the gap between the need to understand a new domain which has huge implications and the lack of extant knowledge, this research aims to answer the question of what are the key factors of consumers' adoption for Open Banking and how do the factors affect the adoption. There are two specific objectives to achieve: firstly, to examine how an adoption model empirically explains and predicts the adoption of a new domain; and secondly, to further integrate the understanding of risk, trust and financial literacy in the adoption of Open Banking which is a financial technology innovation.

To achieve the research question and objectives, a conceptual model with 11 hypotheses (Fig. 3.2) is drawn and validated. Firstly the UTAUT constructs (performance expectancy, effort expectancy and social influence) are hypothesized to positively influence usage intention. Initial trust is hypothesized to directly and positively influence usage intention whereas perceived risk is believed to negatively affect usage intention. Moreover, initial trust is hypothesized to be a positive factor to performance expectancy and effort expectancy, and it can also reduce perceived risk. Furthermore, effort expectancy is hypothesized to positively affect performance expectancy and can reduce perceived risk as well. Lastly financial literacy is hypothesized to be a moderator to strengthen the effects of performance expectancy and effort expectancy on usage intention. This conceptual model is strongly established with only 2 (out of 11) hypotheses not supported, namely, initial trust as a direct antecedent to usage intention, and financial literacy as a moderator to performance expectancy and effort expectancy on usage intention. It means the four domains of theories applied: UTAUT, initial trust, perceived risk and financial literacy all play significant roles to usage intention of Open Banking, with UTAUT and perceived risk playing direct roles while initial trust and financial

literacy playing indirect ones. At the same time the study also enlightens some new angles of findings, with the final model depicted in Fig 5.1 and will be discussed in depth in the following.

To achieve the first objective of examining how an adoption model empirically explains and predicts the usage intention of Open Banking, the study finds that the UTAUT constructs: performance expectancy, effort expectancy and social influence are significant influencers to usage intention, with performance expectancy being the predominant driver. These findings are completely in line with UTAUT. In terms of proving all three constructs are significant to usage intention, this study is consistent with a few internet banking and mobile banking studies (Martins, Oliveira & Popovič 2014; Sok Foon & Chan Yin Fah 2011) but not majority of the others (e.g. Oliveira et al. 2014; Sarfaraz 2017; Yu 2012; Zhou, Lu & Wang 2010). The possible explanation to this phenomenon is that Open Banking is completely new to consumers, who may form their judgement based on multiple factors to make a best informed decision. Whereas in the case of mobile banking and internet banking (which customers have certain familiarity with) they will focus their decision on less and selective factors e.g. how useful it is rather than how easy to use it or whether others are using it.

It will also be interesting to draw comparison of this study to adoption of open government (Zuiderwijk, Janssen & Dwivedi 2015), to provide a cross comparison of open data adoption in different sectors. The open government study, also applying UTAUT constructs, finds that performance expectancy, effort expectancy and social influence are significant to usage intention. It is consistent with the results found in this study. With an additional construct voluntariness of use, the R^2 of that model is 0.45, meaning 45% of the variance of usage intention can be explained. The integrated model in this study explains 69.5% of the variance of usage intention, which is remarkably higher. Although there could be many factors contributing to the difference, it provides a signpost that there are more factors than UTAUT constructs to explain an adoption of open data and an integrated model like this study with risk and trust considerations should be considered to provide higher explanatory power.

This research also finds other interacting relationships among the UTAUT constructs. Firstly, effort expectancy can strengthen performance expectancy. In TAM, perceived ease of use is an influential factor to perceived usefulness, however this relationship is not in the UTAUT model and is less validated in subsequent UTAUT research. The findings from this research

is consistent with a few studies that have made such hypothesis (Alalwan, Dwivedi & Rana 2017; Rahi, Abd.Ghani & Hafaz Ngah 2019; Zhou, Lu & Wang 2010), suggesting this relationship should not be neglected. Secondly, and most interestingly, it is found that social influence has a strong mediating effect through performance expectancy. This gives a contrary view to the extant research that social influence is always posited as a direct antecedent to usage intention and raises a possible rethink if the effect of social influence has been underestimated. Some conclude that it is insignificant due to the private nature of financial technology (Oliveira et al. 2014) or social parity (Baptista, Gonçalo & Oliveira 2015). In fact, as evident by this research, social influence may have an important role to play; rather than through a direct impact on usage intention, it strongly influences the dominant factor – performance expectancy. This supports the view that social influence plays an internalisation role rather than a normative role to usage intention (Kesharwani & Singh Bisht 2012).

To fulfil the second objective of integrating risk, trust and financial literacy into an adoption model for a financial technology, the model has the following findings. Firstly it finds that perceived risk has significant but relatively minor influence on usage intention. Moreover initial trust does not have a direct significant relationship to usage intention, but it acts through perceived risk and can strongly offset perceived risk. While the conclusion of perceived risk being a negative factor to usage intention is consistent with various studies (Chen 2013; Featherman & Pavlou 2003; Luo et al. 2010; Martins, Oliveira & Popovič 2014; Wessels & Drennan 2010), as argued in the literature review, the relationship between trust, risk and usage intention is much less than a structured discussion in those studies. The directionality of initial trust to perceived risk identified from this study confirms the earlier seminal work (Mitchell 1999; Pavlou 2003). The necessary channel for initial trust to affect usage intention is to act through perceived risk; this provides a strong case that future adoption studies should assess this mediating relationship, otherwise the null direct effect of initial trust may drive a conclusion omitting its influence. Moreover, financial literacy in fact plays a direct role to negatively affect initial trust. It is a fresh perspective to both the role of financial literacy and the influencing factors of initial trust. Not only are the roles of perceived risk, initial trust and financial literacy established, their interesting interactions with UTAUT variables are also identified, demonstrating the integrated power of the model. For example, this study finds effort expectancy can help to alleviate risk. Though there is rare discussion on this relationship, this finding empirically supports that of an earlier mobile

banking study (Martins, Oliveira & Popovič 2014) which points out effort expectancy can reduce perceived risk. Initial trust also has significant impact on effort expectancy and performance expectancy. These findings are consistent with a few previous studies (Gao & Waechter 2017; Pavlou 2003). In fact, its multi-faceted influence makes it the third most important construct to usage intention by total effect.

This research emphasises Open Banking as a financial technology innovation, where understanding should go beyond the traditional adoption factors and incorporate risk, trust and financial related factors. The resultant model has good model fit, explanatory power and predictive power, indicating it can satisfactorily explain and predict the usage intention of Open Banking. In the next sections, contributions and implications will be drawn for both theoretical and practical aspects.

6.2 Theoretical Contributions

This research study is one of the first that incorporates UTAUT, risk, trust and financial literacy theories to gain empirical understanding of a new domain of Open Banking. Its originality and the interesting findings identified help to contribute and enrich theoretical understanding in the following ways:

- Extending the application of UTAUT to Open Banking domain
- Demonstrating an integrated approach to theorise Open Banking adoption
- Illuminating a financial perspective in adoption studies

Each contribution is discussed in detail below.

Extending the application of UTAUT to Open Banking domain: Open Banking is a novel topic with wide implications. There is a paucity of research, let alone empirical studies, despite its wide implications and impact as discussed in the introduction section. Understanding the adoption behaviour from an end user perspective is of paramount importance and lays the ground for investigating other related consumer behaviour topics in the area.

While UTAUT is a widely used model to explain adoption, not all UTAUT studies in the literature review demonstrate that performance expectancy, effort expectancy and social

influence are consistently significant to usage intention. Despite Open Banking being a new domain of financial technology, this study finds that all three constructs are able to satisfactorily explain the usage intention. In particular, performance expectancy is a consistent, powerful predictor in the adoption decision. It reinforces that UTAUT constructs are useful in explaining adoption, and they should continue to be considered as the core attributes for the upcoming research.

Besides successfully applying UTAUT in a new context, this study also discovers that the constructs have more interesting, interactive relationships than the previous literature have shown. It highlights that the role of social influence might have been underestimated: social influence in fact mediates strongly through performance expectancy, making a much higher overall impact on usage intention than it would be if only taking direct effect into consideration. Effort expectancy plays multiple effects too, which can reduce perceived risk but at the same time increase performance expectancy. These interactions provide stimulating thoughts and fresh paths for researchers to consider in future studies.

Demonstrating an integrated approach to theorise Open Banking adoption. This study calls for and demonstrates an approach to systematically and structurally integrate both trust and risk into an adoption framework. Risk and trust have been increasingly noted as concerns by consumers when it comes to Fintech and have gained traction in both academia and the industry. The complexity and uncertainty of technology coupled with the sensitive nature of finance and personal data poses uncertainty and perceived risk to consumers (Chellappa & Sin 2005; Cunningham, Gerlach & Harper 2005; Pavlou 2003). The financial crisis and various negative incidents in the industry make consumers increasingly concerned about the trust issue of the institutions providing the service (Arner, Barberis & Buckley 2016; Australian Government 2019; Lewan 2018).

As discussed in the literature review, although there is some literature taking risk and trust into consideration, most of them use fragmented or inconsistent approaches in relating the two factors to adoption. Also, risk and trust are quite often not treated distinctively and the directionality of their relationship is not well understood. Against this backdrop, this study of Open Banking aims to address these issues and argues that risk and trust should be an integral part of modern technology adoption studies. The conceptual relationship between them was adapted from the early work of Pavlou (Pavlou 2003), but more specific and elaborated to

suit the modern context of Open Banking. For trust, a conscious choice of distinguishing initial trust from knowledge-based or general trust is made, which is a closer reflection of reality when one has to form trust without prior knowledge of a technological innovation (Kim, G, Shin & Lee 2009). For risk, the specific facets related – performance risk, financial risk and privacy risk – are chosen among various risk aspects (Featherman & Pavlou 2003). The results of this study provide clear evidence that risk and trust are separate constructs, and the directionality of their relationship is that trust acts through risk to usage intention by reducing it.

The resultant model has high explanatory power of usage intention of Open Banking. The value of an integrated model lies in the diagnostic power of understanding what drives usage intention for a modern financial technology and providing new insights on their complex, intertwined relationships. For instance if only UTAUT is used, one may continue to focus on performance expectancy and effort expectancy as the important factors. However as this study shows, the adoption intention goes far beyond these functional considerations. Initial trust, as strongly affected by firm reputation, is in fact more important than effort expectancy, and it affects performance expectancy. Initial trust can also alleviate perceived risk which is a negative direct antecedent to usage intention. Trust and risk work on the psychological side of humans and this study shows they have an intertwined relationship with the functional considerations when it comes to adoption. Indeed, from UTAUT which was used to explain adoption behaviour in an organisational IS context, to now an era flourishing with new technologies in a consumer-driven context, people apparently come with different dispositions and concerns towards technology innovations. Not surprisingly, an adoption decision could be more complex and go beyond functional considerations. As demonstrated, this study displays a structural and integrated approach in explaining and predicting adoption, offering new insights in the interaction of these factors.

Illuminating a financial perspective in adoption studies. This study finds that financial literacy plays a role in lessening initial trust which in turn is an important factor in adopting Open Banking. While financial literacy has been of wide interest in various financial behaviour studies, it receives rare consideration (if any) in technology adoptions which may lead to a change in financial behaviour. This study casts new light on the extant literature by showing that one's financial knowledge is indeed one of the factors affecting adoption of Open Banking. Also, the study finds that the number of institutions that one has a relationship

with will also affect adoption of Open Banking. As a precursor, financial relationships may also influence adoption, and more in-depth research is encouraged to discover what other indicators of financial relationship may be influential. Nonetheless, since Open Banking is a technology adoption that may lead to a change in financial behaviour, this research contributes to widening and enriching the adoption perspective by including new and cross-disciplinary financial perspectives.

6.3 Managerial Implications

Open Banking is driven by many governments around the world in order to promote consumer fairness and competition. Its impact on the banking industry and consumer behaviour can be profound. With Open Banking, the behaviour for consumers in choosing products and financial institutions may change, their loyalty may be shaken and there will be new rivals including neobanks (Fleeting 2019), which serve customers with completely different propositions and interactions without branches. Industry estimates that some 13% of bank profits would be at risk because of Open Banking (Yeates 2020). Facing a potentially big and structural change impacting profits, business models and customer loyalty for the industry, this research provides practical insights and contributions in the following ways:

- Helping business managers to understand consumer implications and make informed business strategies
- Offering understanding to marketers on targeting, branding and communication considerations
- Steering product development priorities for technical developers
- Providing insights to policy makers on an optimal regulatory approach and other wider implications

Each point will be discussed in the following paragraphs. Of note, though this study is Australian based, as reasoned in 4.3.4, the Australian banking system and people's education in many ways are comparable to other established countries. In particular, the current pioneering countries share similar maturity in the banking system and market practice. Although the market and cultural factors should not be neglected (like perceived risk as discussed in 5.4.4), the objective of this research and the learnings are intended to be generalized for an international perspective as of this stage of development.

To business managers of Open Banking. This study views Open Banking from the consumer's angle to understand what will affect their adoption of Open Banking. While consumers are largely driven by the benefits and usefulness of Open Banking, they in fact also rely on other people in their social circle to help them understand the benefits. At the same time they place more emphasis on the initial trust than on perceived risk towards Open Banking, and initial trust is mainly formed by the firm reputation. By understanding these consumer implications, this research adds value in helping the business managers to make informed business strategies. It provides clear highlights on the importance of different factors and their priorities for people to adopt Open Banking. Whether it is an existing bank or a new entrant, the first priority should be put on making a compelling proposition as to what are the benefits of using Open Banking (performance expectancy), for example, easy search for better offers, saving/gaining interest rates, personalised products, quicker approval, easy account opening or switch over etc. The benefits should not be just easy to understand, but a clear use case that is easy to articulate too, as social influence has a large effect on performance expectancy.

The importance out of initial trust as a critical factor primarily driven by firm reputation means that trusted brands will have advantage. Given the many issues and incidents revealed in relation to breaching compliance, business ethics, mistreating customers, data leakage etc. after the global financial crisis, there is a growing distrust towards banks (Arner, Barberis & Buckley 2016), with some surveys reporting that 42% of customers who said their trust with the banking industry has deteriorated in the last 12 months (Deloitte 2019). Another survey also finds that after the 2008 global financial crisis, consumers have more trust in technology firms than they have with banks (Arner, Barberis & Buckley 2016). Firms, whether banks or non-banks, should examine and understand their trust level in consumers' mind and think of strategies to build or leverage their reputation. The reputation could be built or leveraged upon excellent product/service and reliable technology (performance expectancy), customer-friendliness (effort expectancy) and data security and privacy (perceived risk). For the less recognised brands acting as challengers, as performance expectancy has a predominant impact, they may combat this from a different end by focusing on innovative and outperforming benefits that make people excited to share in social circles, hopefully overcoming the brand disadvantage.

To marketers of Open Banking. This study provides a positive message: social influence helps. In other words, once the early adopters accept Open Banking, the adoption can ripple out and help the diffusion process more effectively to reach the critical mass required. The marketers should largely leverage early adopters and their social networks to help advocating and promoting benefits (performance expectancy). For instance, a social media strategy to share the benefits after adoption by key opinion leaders to endorse a good user experience can be utilised. While perceived risk exists as an inherent concern for financial technologies, the good news is that it would not critically deter people from using Open Banking, and in fact can be offset by trust. Drawing from the previous trust discussion, marketers, after assessing their brand strength, can also play up their brands as trusted brands to induce trial.

Another strategy concern is targeting. The findings from this research shows that by and large age, income and gender play no role in moderating the relationships. This is again good news as it means that Open Banking appeals to a fairly wide group rather than a specific segment. But education, financial relationship and financial literacy do matter. The first two factors mean at the initial stage, to attract early adopters and create the social influence effect, those with higher education and having multiple institution relationships should be targeted. At the same time, the note of caution is that as this group is likely to be financially literate, and they may be less inclined to trust the players. It will actually take more effort to convince and build trust with this cohort.

To Open Banking technical developers. The aforementioned priority of performance expectancy also applies to developers, as they need to investigate the functionalities and technicalities of Open Banking to provide exceptional benefits. Although effort expectancy only has limited direct impact on adoption of Open Banking, as discussed, it should be cautioned that effort expectancy may be a taken for granted expectation. Besides, effort expectancy also has positive effects on performance expectancy and can reduce perceived risk effectively. Therefore the product developers should not overlook but should thoroughly understand the expectation that users have in terms of navigating and interacting on Open Banking. This should drive the design of screen flow, buttons or pages that one has to navigate, the way of guiding to operate or responding to problems, look and feel etc. to make the product intuitive and self-guided. If learning to use is almost effortless and the interaction is seamless, people will think that the product is more useful and less risky.

To policy makers and governments. In the introduction section, it was mentioned that internationally governments embrace different philosophies in driving and regulating Open Banking from a centralised, government driven approach to an organic, industry-led approach. The former believes that a centralised approach will provide trust and protection to consumers which will help quicker adoption, while the latter sees an industry approach will provide more flexibility to market and thus speed up adoption. The findings from this study show that an optimal governance approach may lean towards the centralised approach.

Firstly, initial trust is important and largely driven by firm reputation. Therefore the centralised approach of providing an accredited list of providers can help building initial trust by sending a message to consumers that these providers are trustworthy and have been endorsed by the policy makers. Secondly, a standardised technical specification also helps effort expectancy because this will help the interoperability of Open Banking between providers. Interoperability is of paramount importance to open data exchange (Charalabidis et al. 2018). Exchanging data on the same protocol and data standard will make the process more seamless and with less frictions. This will make consumers perceive it as easier to learn and use, which in turn will make them feel it is more useful and less risky, as the study shows that effort expectancy reinforces performance expectancy and reduces perceived risk.

As a contrarian view to the centralised approach though, a standard or central structural assurance scheme may not be necessary. As reflected by the study, structural assurance is less of a concern, for the reputable firms should/would bring along their own assurance to consumers. Therefore leaving structural assurance to the market force would be a good strategy to enable a faster implementation while not affecting the usage intention.

Lastly, the intent for governments to implement Open Banking is to promote consumer fairness. This is assuming all consumers, regardless of their financial knowledge, have similar ability to comprehend the benefits and operate Open Banking. The result of financial literacy having no influence on performance expectancy and effort expectancy to usage intention is a positive confirmation to this assumption. The interesting role of financial literacy in making people more sceptical in having trust is perhaps not expected, but it is only a reflection that some people possibly have a higher standard to believe rather than a fairness concern.

For wider governmental implications, it is discussed in the introduction section that Australia is using Open Banking as a pioneer for applying open data concept in other commercial sectors and some governments are also pursuing the same to be applied in the public sector. The wide adoption of open data in different sectors may bring fundamental societal changes and benefits. The learnings from this Open Banking study act as a good precursor to the governments. The data sensitivty and the financial consequence associated with Open Banking are considered to be on the high end and therefore the conclusion of what drives consumer to adopt can set a standard for other sectors to borrow.

6.4 A Closing Remark of Open Banking as an Innovation

In the introduction, Open Banking is defined as an innovation and is further classified as an innovation that is technology in nature and service in outcome. Thus technology adoption theories and literature in banking service innovations are drawn; with insights from the study contributed to enrich the respective domains. A question often asked is how impactful an innovation can be, to which a spectrum of incremental, really new to radical is drawn with radical innovations usually only account for 1/8 of all innovations (Garcia & Calantone 2002). To qualify as a radical innvoation, it should be a combination of distinctive, unique elements and settings not previously observed, as well as an invention in the industry that allows for creation of new elements (Dahlin & Behrens 2005). Open Banking offers a new service via a new technology (API), both of which did not exist before and may fundamentally change some of consumers' banking behaviour in choosing and buying banking products, and consequently their loyalty. This may in turn drive a different competitive landscape. The adoption by consumers may trigger existing players and invite new players to create new products, services, distribution channels and even technologies. Thus Open Banking can be regarded as a radical innovation and it presents a strong case of technology innovation where understanding of its adoption is of critical importance.

6.5 Research Limitations

Like all research, this study has limitations to be noted. Firstly, the study focuses on consumers' perceptions of Open Banking rather than their actual experience to draw findings.

As it stands, Open Banking is unfamiliar and only conceptual to the respondents. The study requires their comprehension and possibly some imagination of how it works in the duration of a survey. There is no real product to show in the research process. To make their perception as close as possible to the actual experience, several measures are adopted. While concept testing always presents certain challenges, it can be mitigated by presenting the concept clearly, fairly and sufficiently as well as using stimuli (Klink & Athaide 2006). The study adopts public information about Open Banking in plain language, with mocked up screens to mimic the flow and help respondents' visualisation. An example is also included to help them understand the use case. Furthermore, checking questions are built in to make sure they grasp the key nature of Open Banking. These measures are believed to mitigate the gap between perceptions and reality at the best level.

Secondly, Open Banking is presented as an independent, standalone concept in the survey. In reality, it will mostly work as an integral part of an ecosystem comprising of different parties and interactions. Open Banking is a tool to facilitate financial information exchange, decision making and switching. As of now there is no clear mandate from governments about its form of existence with financial institutions. However, from a business model perspective, it is not hard to imagine that Open Banking existing as a standalone tool will evolve into a comparison engine, and hence may not make much revenue sense. Therefore Open Banking is likely to exist as an integral part of an institution's business model. A case in point is where HSBC in UK developed a standalone Open Banking app called "Connected Money", but recently decided to integrate the app into its mobile banking app (Flinders 2019). Another possible scenario is where a neobank can partner with an Open Banking provider. When approaching new customers, the neobank can ask them to give consent for accessing and assessing their financial information, then tailor and compare an offer with their current banks to facilitate decision and account switching. In this process it is not necessary to flag the existence of Open Banking, because it is working transparently behind the scenes and has been embedded in the sales process. As such, how Open Banking exists in the ecosystem as to how Open Banking appears and interacts with other parties to provide various functions may raise additional or different scenarios. They could alter the adoption intention as compared to purely a concept on its own. However, it is crucial to form a baseline understanding based on the fundamentals of Open Banking, which is allowing financial information exchange in return for easy comparison and better offers, before other potential

factors come into play. This study serves to achieve this purpose by capturing and forming a clear understanding of the concept adoption for other factors to build on.

Thirdly, the study focuses on the adoption intention of general public without specifically investigating into the early adopters' characteristics. The study represents how Australians generally view Open Banking and does not go into group analysis due to the sample size limitation. Therefore, it does not specifically analyse the behaviours and characteristics of early adopters who may present some differences, the understanding of which can lead to a different discussion regarding the targeting and diffusion strategy.

6.6 Future Research Directions

This research study is one of the first to contribute to adoption knowledge in Open Banking, an evolving concept and one which is transferrable to other sectors. As such, the findings from this research open up a wide scope of opportunities for continued research in various ways.

Firstly, when Open Banking becomes a real application, research can be advanced based on real Open Banking settings. As the implementation of Open Banking unfolds, there will be more solid information and clarity including who can provide it, how it is provided, what it can offer, and some live applications may even be available. This provides an opportunity to address the two research limitations as discussed in the previous section: usage intention is based on perceptual rather than real experience, and Open Banking is less likely to operate as a standalone concept but an integral part of an ecosystem. An experimental approach can be used to present a real Open Banking setting and findings can be drawn on actual interaction experience vis-a-viz other agents or factors in a real ecosystem.

Secondly, it is also possible to make theoretical extensions when Open Banking become operational and the use cases become even clearer. For example, UTAUT2 (Venkatesh, Thong & Xu 2012) and specifically hedonic motivation can be included to see if it affects usage intention, and further hypotheses can be made to check if it helps effort expectancy (a significant factor identified in this study) or whether people will trade off firm reputation (place less emphasis on it) as a result of hedonic motivation. Hedonic motivation or perceived enjoyment has been advocated in some academic work for innovative consumer settings

(Baptista, Goncalo & Oliveira 2017; Rao & Troshani 2007). In some UTAUT2 studies, it even outweighs the traditional UTAUT constructs (Alalwan, Dwivedi & Rana 2017; Baptista, Gonçalo & Oliveira 2015). Indeed, with Open Banking, neobanks are enabled to compete in innovative ways. They endeavour to provide a very user-friendly, untraditional interaction experience that makes one feel s/he is not using a banking app but an enjoyable lifestyle app. The screen flow, design and wordings are grounded in a proposition of making banking easy and pleasant (see example of Xinja in Appendix C).

Another suggested theoretical extension is TTF (Goodhue 1995; Goodhue & Thompson 1995), whereby the functions of Open Banking (technology and task characteristics) can be specifically defined to determine the task-technology fit, and to explore if task-technology fit can extend the understanding of performance expectancy and enhance the explanatory power of utilization. Comparisons can be drawn to previous extended studies of financial innovations (Ahmed et al. 2017; Oliveira et al. 2014; Tarhini et al. 2016; Zhou, Lu & Wang 2010) to affirm or contradict the role of TTF in Open Banking.

Thirdly, the findings from this research form the starting point for other related topics. For instance, with the understanding of what drives the adoption intention, this may be expanded into how the adoption may result in consumer choice behaviour. Open Banking presents a new way of obtaining and comparing information and offers, which means the way consumers receive and process the information, the switching cost (e.g. time involved) as well as decision making may be different from what is current. How the adoption eventually translates into a possibly different process of choosing a product and an institution will be interesting and valuable, both theoretically and practically. Besides customer choice, another extended topic is customer loyalty as a result of adopting Open Banking. Longitudinal studies can be done to track how a customer's loyalty might be changed after adopting Open Banking. In fact these two aspects are the key expected impact of Open Banking, and taking the understanding further from adoption should deliver holistic, insightful contributions.

Finally, similar research can be extended to cross sectors and cross cultural contexts. As it stands in Australia, Open Banking will be used as the first application of open data and the same concept will be eventually rolled out to transform other sectors like energy, telecommunications and insurance (Australian Government 2017; Kehoe 2019; Mark 2018). Open data as a category domain is an emerging research agenda involving governmental,

academic or commercial interests, but theoretical contributions thus far are scarce (Zuiderwijk et al. 2014; Zuiderwijk, Janssen & Dwivedi 2015). It could enable a transformation to data economy by bringing down information barriers and unlocking many innovations (Charalabidis et al. 2018). With the same essential underlying principles of openness, data control and transparency, the learnings from this Open Banking study involving adoption, risk and trust may provide parallel insights into other sectors. It is proposed that other sectors might adopt the same line of thought and validate this integrated model in different settings. Moreover as the findings point out, the effect of perceived risk can be culturally driven and its effect on adoption can be validated in different cultural contexts. These validations can help to start accumulating the knowledge for the category domain which may be influential upon the future of our societies.

6.7 Summary

As a concluding chapter of this thesis, this chapter revisited the research objectives and question which have been satisfactorily accomplished. Based on the findings, the contributions to both academics and practitioners are drawn. The research makes three theoretical contributions. Firstly, it extends the application of UTAUT to empirically understand a new emerging domain. Secondly, it demonstrates a structural and systematic approach to integrate perceived risk and initial trust into an adoption model, and illustrates their complex, interesting interactions. Thirdly, it discovers and adds financial perspectives – financial literacy – to Open Banking adoption as a financial technology innovation. For practical contributions, this study provides good understanding to Open Banking business managers (whether of existing banks or challengers), marketers and technical developers on the priorities of driving consumer adoption. Value-adding recommendations are made with regards to forming business, product development, targeting and marketing strategies. This study also provides insights to policy makers on an optimal approach to implement Open Banking in light of risk and trust concerns. It supports that the initiative does not just work for certain segments and that consumer fairness can largely be attained. While the research limitations mainly stem from the current situation of Open Banking being a standalone concept, suggestions on future research directions have been made to take the validation further to actual experiences, and to extend the understanding to topics like consumer choice and customer loyalty as a result of adoption. It also suggests the learnings from Open Banking can be drawn for parallel insights and further tests in other sectors.

Appendix A – Difference in Country Implementation Approaches and Implications

Difference in approach	Description	Implication to consumers in adoption
Scope of deployment	To the narrow end, EU deploys it to payment services only while to the wide end, Singapore deploys it to insurance and asset management as well. The majority of others like the UK, HK, Australia apply Open Banking to general banking products and services.	This will affect the scope of products and services customers can access on Open Banking and hence the perceived usefulness of Open Banking.
Operation standard	This includes technical standard, data format, functions, security standard and consumer protection principles. The UK takes a government-led approach in defining the details, whilst Singapore, Australia and Canada also follow this approach. Hong Kong and the US adopt an industry-led approach leaving industry to initiate and agree among themselves.	It is possible that different technical standards may be deployed by different API providers and affect the interoperability. Consumers may face difficulties to understand what different standards mean to them. As a result a longer education process may be needed. This will increase consumers' perception of complexity and the effort to learn to use Open Banking.
Governance	The UK and Australia have the strictest governance by licensing to who can be an Open Banking API provider, whereas others are less specific in this area.	A central governance approach can facilitate consumers to recognise accredited service providers. Customers can have assurance of the providers' quality with government accreditation system. This will likely affect their trust in Open Banking. On the other hand, a less specific governance and accreditation system may increase consumers' perceived risk in Open Banking, as they face more uncertainty of who is providing the service and the service quality.
Banks' participation	The UK adopts a mandatory approach and currently mandates 9 big banks[3] covering more than 80% market share (Manthorpe 2018) to participate. Australia follows to use a mandatory approach. Others like Singapore and Hong Kong believe in an organic (voluntary) approach.	The more banks that participate in Open Banking, the more choices of products and offers that consumers can access to. This will affect perceived usefulness of Open Banking.

(Australian Government 2017; Badour & Presta 2018; Chanjaroen & Amin 2018; European Commision 2018; Hong Kong Monetary Authority 2018a, 2018b, 2018c; John 2018; Monetary Authority of Singapore 2016; Rothwell 2018; Siddiqui 2017)

[3] HSBC, Barclays, RBS, Santander, Bank of Ireland, Allied Irish Bank, Danske, Lloyds and Nationwide

Appendix B – Scales and Items Comparison

Construct	Adapted from	Original items	Items used in the study	Item no.
Usage Intention	(Venkatesh et al. 2003) 7-pt scale	I intend to use the system in the next <x> months.	I intend to use Open Banking in the future.	UI1
		I predict I would use the system in the next <x> months.	I predict I would use Open Banking in the future.	UI2
		I plan to use the system in the next <n> months.	I plan to use Open Banking in the future.	UI3
Performance Expectancy		I would find the system useful in my job.	I expect to find Open Banking useful in my financial management.	PE1
		Using the system enables me to accomplish tasks more quickly.	Using Open Banking would enable me to accomplish financial tasks more quickly.	PE2
		Using the system increases my productivity.	Using Open Banking would increase my efficiency in financial management.	PE3
		If I use the system, I will increase my chances of getting a raise.	If I would use Open Banking, I increase my chances of getting more competitive banking offers.	PE4
Effort Expectancy		My interaction with the system would be clear and understandable.	I expect that my interaction with Open Banking would be clear and understandable.	EE1
		It would be easy for me to become skilful at using the system.	I expect that it would be easy for me to become skilful at using Open Banking.	EE2
		I would find the system easy to use.	I expect that I would find Open Banking easy to use.	EE3
		Learning to operate the system is easy for me.	I expect that learning to use Open Banking would be easy for me.	EE4
Social Influence	(Oliveira et al. 2014) 7-pt scale	My friends and family value the use of mobile banking.	My friends and family would value the use of Open Banking.	SI1
		The people that influence me use mobile banking.	I expect that the people that influence me would use Open Banking.	SI2
		I find mobile banking trendy.	I expect that Open Banking would be trendy.	SI3
		The use of mobile banking gives me professional status.	I expect that using Open Banking would make me look professional in managing my finances.	SI4

Appendix B – Scales and Items Comparison (cont.)

Construct	Adapted from	Original items	Items used in the study	Item no.
Initial Trust	(Kim, G, Shin & Lee 2009) 7-pt scale	Mobile banking always provides accurate financial services.	I expect that Open Banking would always provide accurate financial services.	IT1
		Mobile banking provides reliable financial services.	I expect that Open Banking would provide reliable financial services.	IT2
		Mobile banking always provides safe financial services.	I expect that Open Banking would always provide secure financial services.	IT3
Perceived Firm Reputation		My cellular service provider has a good reputation.	n/a	
		My cellular service provider is recognised widely.	n/a	
		My cellular service provider provides good services.	n/a	
		My bank has a good reputation.	I expect that the financial data administrators (i.e. firms involve in providing and handling my financial data in the process) of Open Banking would have a good reputation.	FR1
		My bank is recognised widely.	I expect that the financial data administrators of Open Banking would be recognised widely.	FR2
		My bank provides good services.	I expect that the financial data administrators of Open Banking would offer good services.	FR3
Perceived Structural Assurance		Mobile banking firms guarantee compensation for monetary losses that might occur during service usage.	I expect that the financial data administrators of Open Banking would have a compensation policy for monetary losses that might occur during service usage.	SA1
		Mobile banking firms publish a policy on customers' personal information.	I expect that the financial data administrators of Open Banking would have a policy on personal information.	SA2
		Mobile banking firms publish a policy on the protection of transaction data.	I expect that the financial data administrators of Open Banking would have a policy on the protection of transaction data.	SA3
		Mobile banking firms publish a policy on customer protection from accidents.	I expect that the financial data administrators of Open Banking would have a policy on customer protection from accidents.	SA4
Propensity to Trust		I am cautious in using new technologies to do my work.	I am cautious when using new technologies to manage my finances.	PT1
		If possible, it is better to avoid using new technologies for financial services.	If possible, it is better to avoid using new technologies for managing my finances.	PT2
		In a new business relationship, I have to be careful until I see the evidence of a firm's usage.	I have to be careful to use Open Banking until I see evidence of it being used by others.	PT3

Appendix B – Scales and Items Comparison (cont.)

Construct	Adapted from	Original items	Items used in the study	Item no.
Performance Risk	(Featherman & Pavlou 2003) 7-pt Likert and semantic differential scales	The XXXX might not perform well and create problems with my credit. (Strongly disagree / agree)	Open Banking might not perform well and create problems with my accounts.	PR1
		The security systems built into the XXXX are not strong enough to protect my checking account. (Strongly disagree / agree)	The security systems built into Open Banking are not strong enough to protect my accounts.	PR2
		What is the likelihood that there will be something wrong with the performance of the XXXX or that it will not work properly? (Low / high functional risk)	What is the likelihood that there will be something wrong with the performance of Open Banking or that it will not work properly?	PR3
		Considering the expected level of service performance of the XXXX, for you to sign up for and use it would be. (Not risky at all / risky)	Considering the expected level of service performance of Open Banking, it would be _____for me to sign up and use it.	PR4
		XXXX servers may not perform well and process payments incorrectly. (Strongly disagree / agree)	Open Banking may not perform well and may process transactions incorrectly.	PR5
Financial Risk		What are the chances that you stand to lose money if you use the XXXX? (Low / high chance)	What are the chances that you stand to lose money if you use Open Banking?	PR6
		My signing up for and using an XXXX would lead to a financial loss for me. (Improbable / probable)	Signing up for and using Open Banking would lead to a financial loss for me.	PR7
		Using an Internet bill-payment service subjects your checking account to financial risk. (Strongly agree / disagree)	Using Open Banking subjects my accounts to financial risk.	PR8
Privacy Risk		What are the chances that using an XXXX will cause you to lose control over the privacy of your payment information? (Improbable / probable)	What are the chances that using Open Banking will cause you to lose control over the privacy of your banking information?	PR9
		My signing up for and using an XXXX would lead to a loss of privacy for me because my personal information would be used without my knowledge. (Improbable / probable)	Signing up for and using Open Banking would lead to a loss of privacy for me because my personal information would be used without my knowledge.	PR10

Appendix B – Scales and Items Comparison (cont.)

Construct	Adapted from	Original items	Items used in the study	Item no.
Financial Literacy	(Allgood & Walstad 2016)	Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years how much do you think you would have in the account if you left the money to grow? (a) more than $102*; (b) exactly $102; (c) less than $102	Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years how much do you think you would have in the account if you left the money to grow? (a) more than $102*; (b) exactly $102; (c) less than $102	FL1
		Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in the account? (a) more than today; (b) exactly the same; (c) less than today*	Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in the account? (a) more than today; (b) exactly the same; (c) less than today*	FL2
		If interest rates rise, what will typically happen to bond prices? (a) they will rise; (b) they will fall* (c) they will remain the same; (d) there is no relationship between bond prices and the interest rate	If interest rates rise, what will typically happen to bond prices? (a) they will rise; (b) they will fall* (c) they will remain the same; (d) there is no relationship between bond prices and the interest rate	FL3
		A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less. (a) true*; (b) false	A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less. (a) true*; (b) false	FL4
		Buying a single company's stock usually provides a safer return than a stock mutual fund. (a) true; (b) false*	Buying a single company's stock usually provides a safer return than a stock mutual fund. (a) true; (b) false*	FL5

Appendix C – Open Banking Questionnaire

S1 What is your age?

- ○ < 18 (8)
- ○ 18 - 24 (9)
- ○ 25 - 34 (10)
- ○ 35 - 44 (11)
- ○ 45 - 54 (12)
- ○ 55 - 64 (13)
- ○ 65+ (14)

Skip To: End of Block If What is your age? = < 18
Skip To: End of Block If What is your age? = 65+

S2 Do you have any bank accounts?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Do you have any bank accounts? = No

S3 Which region in Australia do you reside in now?

- ○ Northern Territory (1)
- ○ New South Wales (2)
- ○ Victoria (3)
- ○ ACT (4)
- ○ South Australia (5)
- ○ Western Australia (6)
- ○ Queensland (7)
- ○ Tasmania (8)
- ○ None of the above (9)

Skip To: End of Block If Which region in Australia do you reside in now? = None of the above

D1 How would you like to identify your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Other (3)
- ○ Preferred not to be identified (4)

D2 What is your highest level of education to date?

- Some high school, no diploma (1)
- High school graduate, diploma or equivalent (e.g. GED) (2)
- Some college credit, no degree (3)
- Trade / technical / vocational qualification (4)
- Associate degree (5)
- Bachelor's degree (6)
- Master’s degree (7)
- Professional degree (8)
- Doctorate degree (9)

D3 How many banks or financial institutions do you currently have accounts with?

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 or above (please specify the number) (6)

D4 Please indicate the number of accounts (with any bank or financial institution) you currently have for each type of products:

	0 (1)	1 (2)	2 (3)	3 (4)	4 (5)	5 or above (6)
Savings and checking accounts (S3_1)	○	○	○	○	○	○
Credit card (S3_2)	○	○	○	○	○	○
Mortgage (S3_3)	○	○	○	○	○	○
Personal loan / overdraft (S3_4)	○	○	○	○	○	○
Investment account (S3_5)	○	○	○	○	○	○

D5 If you have accounts other than those mentioned above, please specify below.

○ 7 (7) _____

D6 What is your net (after-tax) fortnightly income (take home pay)?

○ $0 - $799 (1)

○ $800 - $1199 (2)

○ $1200 - $1699 (3)

○ $1700 - $2099 (4)

○ $2100 - $2499 (5)

○ $2500 - $2899 (6)

○ $2900 - $3299 (7)

- ○ $3300 - $3699 (8)
- ○ $3700 - $4099 (9)
- ○ More than $4100 (10)
- ○ Irregular income (11)

D7 What is your annual income before taxes (gross)?

- ○ Under $18,200 (1)
- ○ $18,201 - $37,000 (2)
- ○ $37,001 - $90,000 (3)
- ○ $90,001 - $180,000 (4)
- ○ $180,001 or above (5)

D8 Do you know how much of your net household income (%) is used to repay debt (including mortgage, credit card or any form of lending)?

- ○ Yes (5)
- ○ No / I prefer not to answer (6)

Skip To: M1 If Do you know how much of your net household income (%) is used to repay debt (including mortgage,... = No / I prefer not to answer

D9 How much of your net household income (%) is used to repay debt (including mortgage, credit card or any form of lending)?

	0 10 20 30 40 50 60 70 80 90 100
% of net come used to repay debt ()	

M1 Now please let me know what you think about doing exercise.

	Strongly disagree (1)	Disagree (8)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Agree (5)	Strongly agree (6)
I like to exercise a lot. (M1_1)	○	○	○	○	○	○	○
I enjoy exercise a lot. (M1_2)	○	○	○	○	○	○	○
I look forward to exercise a lot. (M1_3)	○	○	○	○	○	○	○

You'll now be introduced to Open Banking. After the introduction you will be asked to answer a number of questions. Open Banking is a financial service innovation enabled by a technology that allows exchange of information between different parties. It comes as an app usable on computers or smartphones. Please read information below. *(Source: www.finder.com.au/open-banking, by Elizabeth Barry. Last updated: 6 August 2019)*

What products are included in open banking?

- Savings accounts
- Call accounts
- Term deposits
- Current accounts
- Cheque accounts
- Debit card accounts
- Transaction accounts
- Personal basic accounts
- GST and tax accounts
- Cash management accounts
- Farm management accounts
- Pensioner deeming accounts
- Mortgages
- Business finance
- Personal loans
- Lines of credit
- Overdrafts
- Consumer leases
- Credit and charge cards
- Asset finance and leases
- Mortgage offset accounts
- Trust accounts
- Retirement savings accounts
- Foreign currency accounts

For the latest on open banking
finder.com.au/fintech

Which organisations can I send my data to and from?

Authorised deposit-taking institutions (banks) will be automatically included in open banking. Other companies able to receive and hold data will need to be authorised in order to accept and hold data through open banking. This is so they adhere to the security standards set by the government.

What's an example of how open banking will work?

There are myriad possibilities for open banking. One is signing up for a new product. Right now, it's easier to sign up for a product such as a loan or credit card with your current bank because they have all of your transaction history and identification documents in their system. With open banking, you will be able to direct that your bank sends that information to any bank or lender so that signing up for a new product will be just as easy anywhere.

How much will open banking cost me?

Open banking will be free for all consumers.

Is sharing my financial data safe?

Safety has been the main concern of the open banking debate. Financial institutions and other companies that participate in open banking will need to adhere to strict security standards when accessing and storing your data and will be subject to the privacy act. These organisations will also only be able to access your data at your request and do what you want with it.

When is open banking happening in Australia?

Open banking began on 1 July 2019. This is the date the Big Four banks – CommBank, NAB, ANZ and Westpac – started to provide data for beta testing of the system. You will be able to access transaction account, credit and debit card, deposit account and mortgage account data from February 2020. You can see the timeline above for other types of data and when the other banks are required to provide access.

Is Australia the only country to do it?

No. The UK has mandated open banking, with the sharing of customer and transaction data via open APIs having been in operation since 1 January 2018.

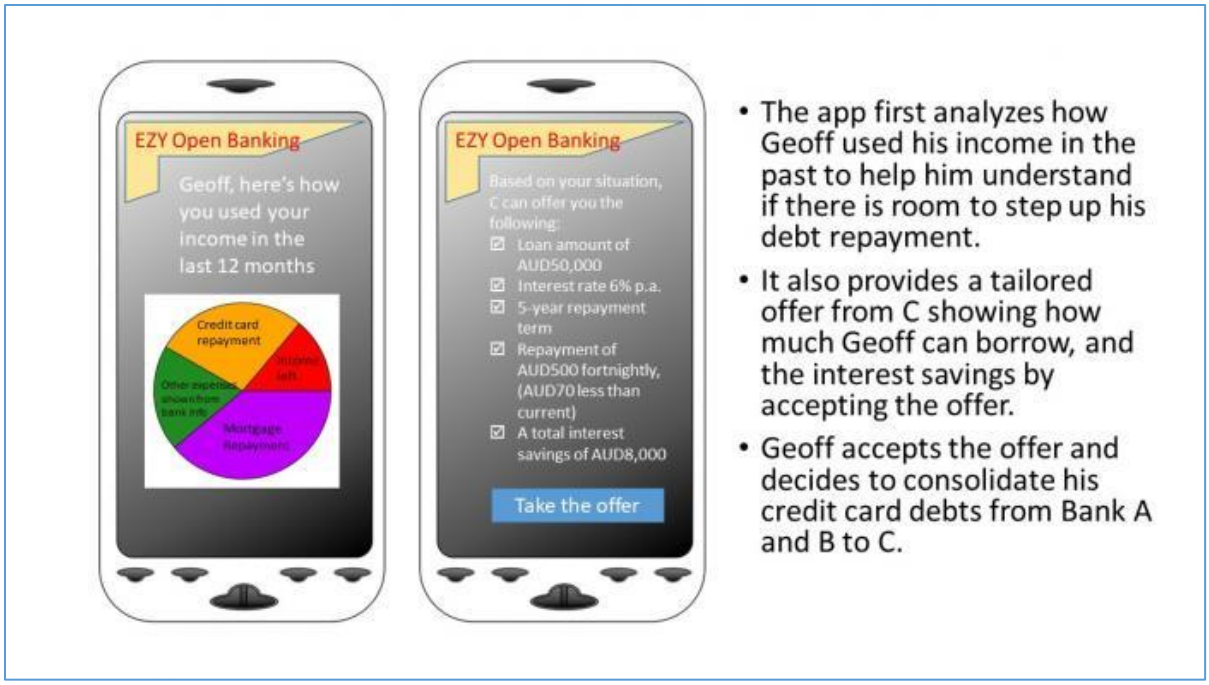
The European Union has also mandated open banking, with payment initiation and account data retrieval by third parties having come in effect in May 2018.

Various other countries, including the US and Singapore, are taking steps towards open banking, data sharing and open APIs.

Also see below a practical example of how Open Banking works.

- This is Geoff. He banks with Bank A and Bank B, and is tired of managing debts on his different credit cards with different payment dates.
- He wonders if he can consolidate his total outstanding debt at a lower interest rate.
- Meanwhile, he heard that a new financial institution C is giving competitive offers.
- However, his banking information is now scattered across different banks.
- Geoff is not sure how C can assess his complete financial position and whether they can offer a better deal than what he currently has with A and B.

- Geoff has heard that Open Banking may help him in this situation.
- He finds an Open Banking provider, EZY, that is licensed by the government and downloads their app.
- Using the app, Geoff gives consents as to what information he wants Bank A and B to share with C.
- Upon Geoff's instruction, Bank A and B have to comply with his request to release information. Open Banking then facilitates the information exchange between the parties.
- In this process, there are a few financial data administrators (i.e. firms involve in providing and handling personal financial data). Geoff does not need to release the log in credentials of his A and B accounts to EZY or C.



C1 Which of the following is true about Open Banking?

- Open Banking is a bank (1)
- Open Banking is a financial innovation that allows exchange of your banking information between different parties (2)
- Open Banking is a payment system that facilitates transfer between different banks (3)
- None of the above (4)

Skip To: End of Block If Which of the following is true about Open Banking? not equals Open Banking is a financial innovation that allows exchange of your banking information between different parties

C2 How could you use Open Banking?

- ○ Your bank will inform you to participate via their website (1)
- ○ Any technology company can provide the service to you. You sign up and the technology company will automatically retrieve the data from your banks (2)
- ○ You download an app from an accredited provider, then give consent to release your banking data to operate on Open Banking (3)
- ○ None of the above (4)

Skip To: End of Block If How could you use Open Banking? not equals You download an app from an accredited provider, then give consent to release your banking data to operate on Open Banking

Q1 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I intend to use Open Banking in the future. (Q1_1)	○	○	○	○	○	○	○
I predict I would use Open Banking in the future. (Q1_2)	○	○	○	○	○	○	○
I plan to use Open Banking in the future. (Q1_3)	○	○	○	○	○	○	○

Q2 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I expect to find Open Banking useful in my financial management. (Q1_4)	○	○	○	○	○	○	○
Using Open Banking would enable me to accomplish financial tasks more quickly. (Q1_5)	○	○	○	○	○	○	○
Using Open Banking would increase my efficiency in financial management. (Q1_6)	○	○	○	○	○	○	○
If I would use Open Banking, I increase my chances of getting more competitive banking offers. (Q1_7)	○	○	○	○	○	○	○

Q3 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I expect that my interaction with Open Banking would be clear and understandable. (Q1_8)	○	○	○	○	○	○	○
I expect that it would be easy for me to become skilful at using Open Banking. (Q1_9)	○	○	○	○	○	○	○
I expect that I would find Open Banking easy to use. (Q1_10)	○	○	○	○	○	○	○
I expect that learning to use Open Banking would be easy for me. (Q1_11)	○	○	○	○	○	○	○

Q4 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
My friends and family would value the use of Open Banking. (Q1_12)	○	○	○	○	○	○	○
I expect that the people that influence me would use Open Banking. (Q1_13)	○	○	○	○	○	○	○
I expect that Open Banking would be trendy. (Q1_14)	○	○	○	○	○	○	○
I expect that Open Banking would make me look professional in managing my finances. (Q1_15)	○	○	○	○	○	○	○

Q5 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I expect that Open Banking would always provide accurate financial services. (Q1_16)	○	○	○	○	○	○	○
I expect that Open Banking would provide reliable financial services. (Q1_17)	○	○	○	○	○	○	○
I expect that Open Banking would always provide secure financial services. (Q1_18)	○	○	○	○	○	○	○

Q6 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I expect that Open Banking would have a good reputation. (Q1_19)	○	○	○	○	○	○	○
I expect that the financial data administrators (i.e. firms involve in providing and handling my financial data in the process) of Open Banking would have a good reputation (Q1_20)	○	○	○	○	○	○	○
I expect that Open Banking would be recognised widely. (Q1_21)	○	○	○	○	○	○	○
I expect that the financial data administrators (i.e. firms providing and handling my financial data in the process) of Open Banking would be recognised widely. (Q1_22)	○	○	○	○	○	○	○
I expect that Open Banking would offer good services. (Q1_23)	○	○	○	○	○	○	○
I expect that the financial data administrators (i.e. firms involve in providing and handling my financial data in the process) of Open Banking would offer good services. (Q1_24)	○	○	○	○	○	○	○

Q7 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I expect that Open Banking would have a compensation policy for monetary losses that might occur during service usage. (Q1_25)	○	○	○	○	○	○	○
I expect that the financial data administrators (i.e. firms involve in providing and handling my financial data in the process) of Open Banking would have a compensation policy for monetary losses that might occur during service usage. (Q1_26)	○	○	○	○	○	○	○
I expect that Open Banking would have a policy on dealing with my personal information. (Q1_27)	○	○	○	○	○	○	○
I expect that the financial administrators (i.e. firms involve in providing and handling my financial data in the process) of Open Banking would have a policy on dealing with my personal information. (Q1_28)	○	○	○	○	○	○	○
Please rate "strongly disagree" for this item. (Q7_58)	○	○	○	○	○	○	○
I expect that Open Banking would have a policy on the protection of transaction data. (Q1_29)	○	○	○	○	○	○	○
I expect that the financial data administrators (i.e. firms involve in providing and handling my financial	○	○	○	○	○	○	○

data in the process) of Open Banking would have a policy on the protection of transaction data. (Q1_30)							
I expect that Open Banking would have a policy on customer protection from accidents. (Q48_56)	○	○	○	○	○	○	○
I expect that the financial data administrators (i.e. firms involve in providing and handling data in the process) would have a policy on customer protection from accidents. (Q48_57)	○	○	○	○	○	○	○

Skip To: End of Block If Q7_58 is not "strongly disagree"

Q8 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I am cautious when using new technologies to manage my finances. (Q1_25)	○	○	○	○	○	○	○
If possible, it is better to avoid using new technologies for managing my finances. (Q1_26)	○	○	○	○	○	○	○
I have to be careful to use Open Banking until I see evidence of it being used by others. (Q1_27)	○	○	○	○	○	○	○

Q9 Please respond to the following statements by indicating your level of agreement from strongly disagree to strongly agree.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
Open Banking might not perform well and create problems with my accounts. (Q1_25)	○	○	○	○	○	○	○
The security systems built into Open Banking might not be strong enough to protect my accounts. (Q1_26)	○	○	○	○	○	○	○
Open Banking may not perform well and may process transactions incorrectly. (Q1_27)	○	○	○	○	○	○	○
Using Open Banking subjects my accounts to financial risk. (Q50_58)	○	○	○	○	○	○	○

Q10 Now continue to what you think the likelihood will be for the following statements, from low to high.

	1. Low (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7. High (7)
What is the likelihood that there will be something wrong with the performance of Open Banking or that it will not work properly? (Q2_1)	○	○	○	○	○	○	○
What are the chances that you stand to lose money if you use Open Banking? (Q2_2)	○	○	○	○	○	○	○

Q11 The below questions ask about your perceived probability of different events from improbable to probable.

	1. Improbable (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7. Probable (7)
Signing up for and using Open Banking would lead to a financial loss for me. (Q3_1)	○	○	○	○	○	○	○
What are the chances that using Open Banking will cause you to lose control over the privacy of my banking information? (Q3_2)	○	○	○	○	○	○	○
Signing up for and using Open Banking would lead to a loss of privacy for me because my personal information would be used without my knowledge. (Q3_3)	○	○	○	○	○	○	○

Q12 Considering the expected level of service performance of Open Banking, it would be ___ for me to sign up and use it.

- ○ 1. Not risky at all (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)
- ○ 5 (5)
- ○ 6 (6)
- ○ 7. Risky (7)

In the following, we would like to know how much you know about dealing with finances. It is OK if you do not know the answer to some or all of the questions, we are interested in your personal perspective.

FL1 Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years how much do you think you would have in the account if you left the money to grow?

- ○ More than $102 (1)
- ○ Exactly $102 (2)
- ○ Less than $102 (3)

FL2 Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in the account?

- ○ More than today (1)
- ○ Exactly the same (2)
- ○ Less than today (3)

FL3 If interest rates rise, what will typically happen to bond prices?

- ○ They will rise (1)
- ○ They will fall (2)
- ○ They will remain the same (3)
- ○ There is no relationship between bond prices and the interest rate (4)

FL4 A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.

- ○ True (1)
- ○ False (2)

FL5 Buying a single company's stock usually provides a safer return than a stock mutual fund.

- ○ True (1)
- ○ False (2)

FL6 On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?

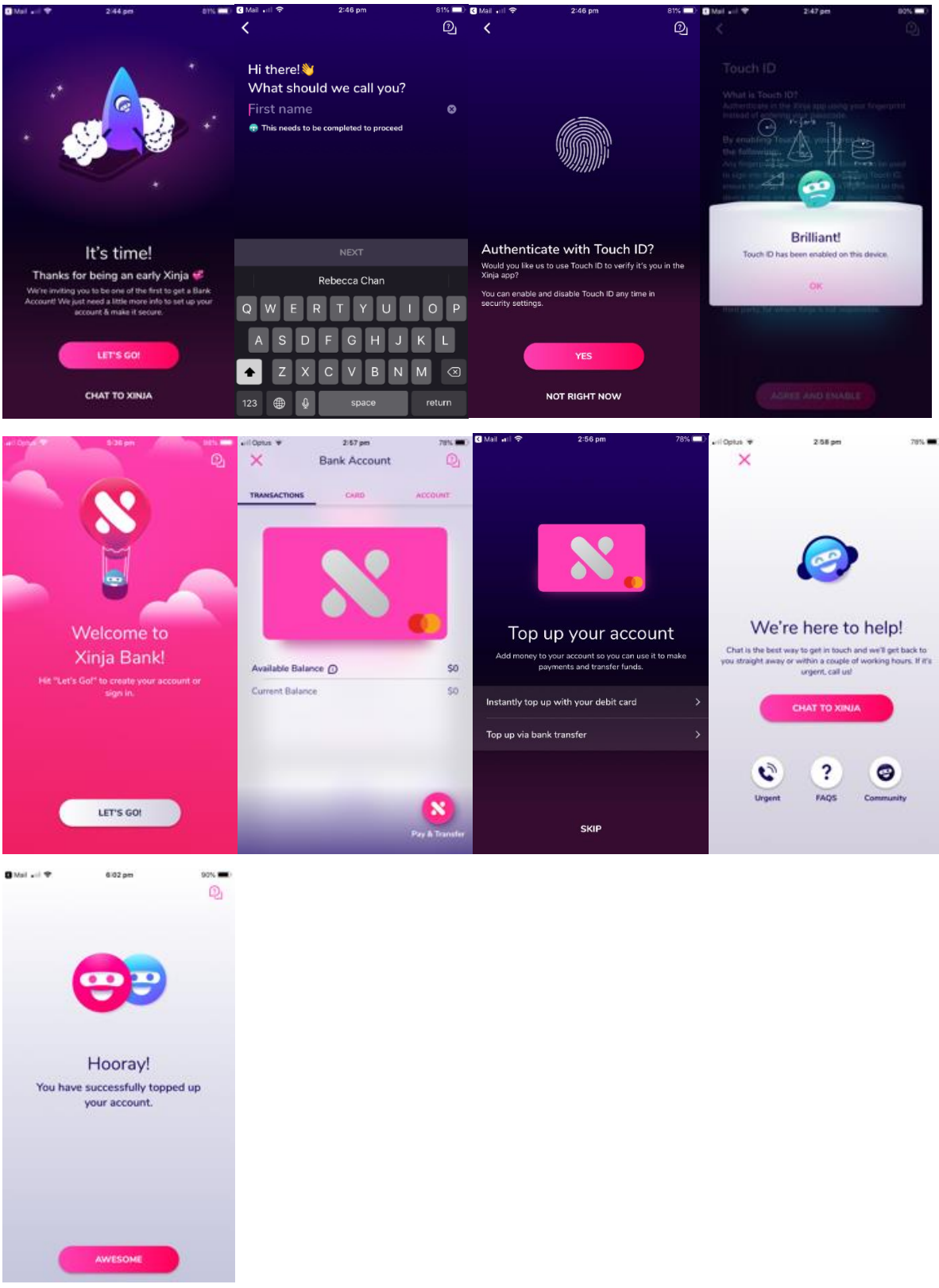
- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)
- ○ 5 (5)
- ○ 6 (6)
- ○ 7 (7)

FS1 Please indicate your level of agreement to the following statements.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (8)	Agree (5)	Strongly agree (6)
I know the right sources to consult to make wise financial decisions. (FS_1)	○	○	○	○	○	○	○
I know how to make complex financial decisions. (FS_2)	○	○	○	○	○	○	○
When it comes to money, I know how to be disciplined. (FS_3)	○	○	○	○	○	○	○
I am able to make good financial decisions that are new to me. (FS_4)	○	○	○	○	○	○	○
I know how to make myself save. (FS_5)	○	○	○	○	○	○	○
I am able to recognise a good financial investment. (FS_6)	○	○	○	○	○	○	○

This is the end of the survey and thank you for participating

Appendix D – Example of a Neobank's App (Xinja)



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